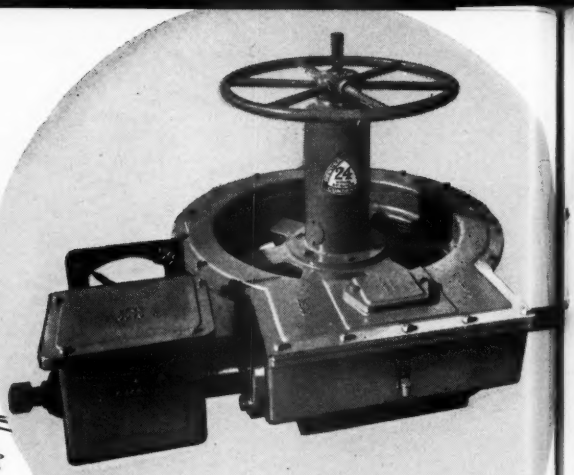
MINING CONGRESS JOURNAL

DECEMBER 1959

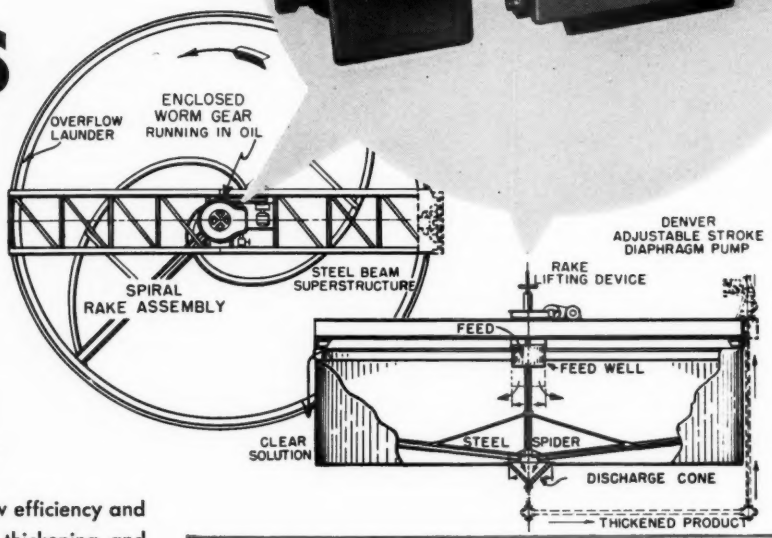
DENVER

Spiral Rake THICKENERS



✓ Simple
✓ Low Cost

...for all thickening, waste treatment and clarification operations



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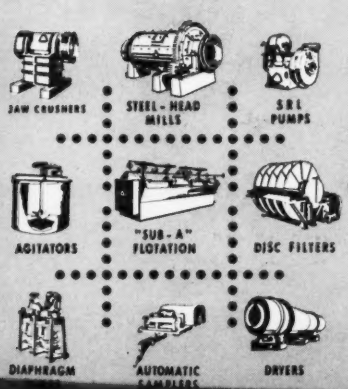

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Opinions expressed by the authors within these pages are their own and do not necessarily represent those of the American Mining Congress.

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ON OUR COVER

Our warmest wishes for a very merry Christmas and a happy and prosperous New Year!
Photo by Abbie Rowe—Courtesy National Park Service

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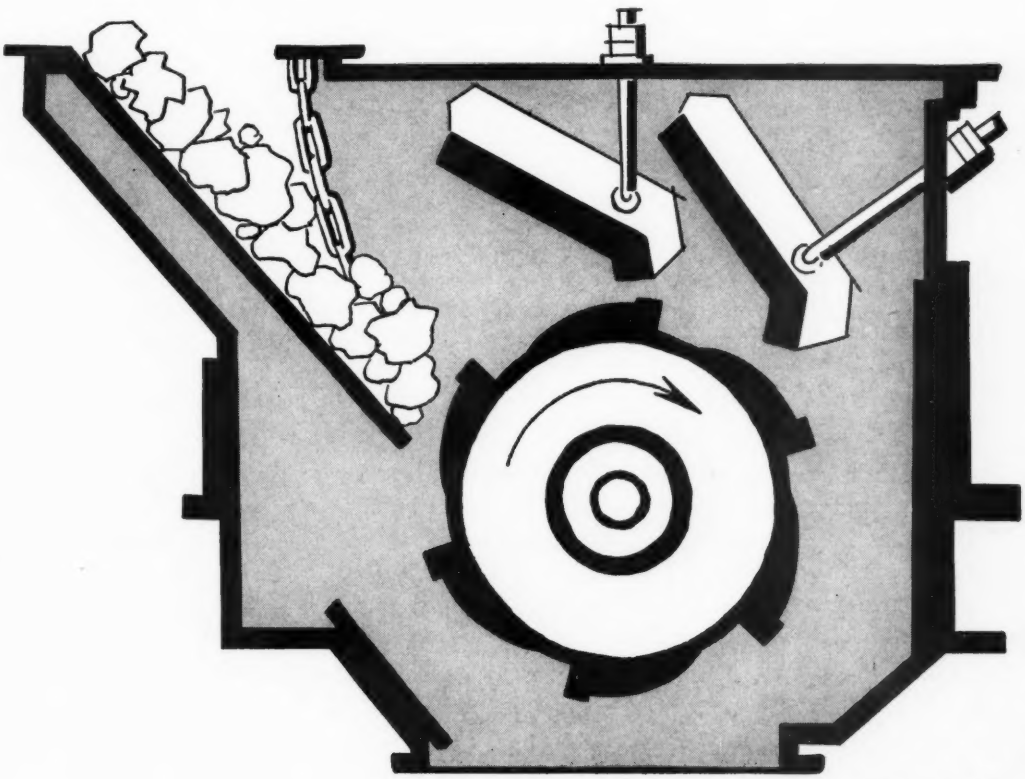

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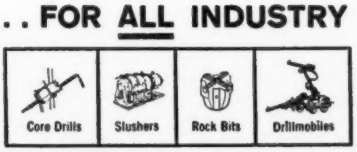

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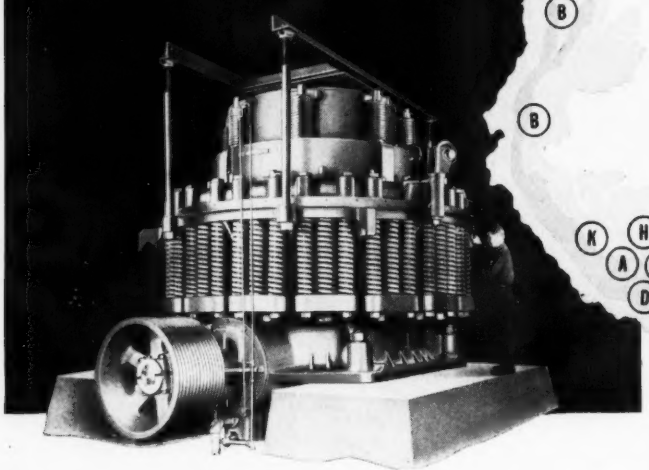

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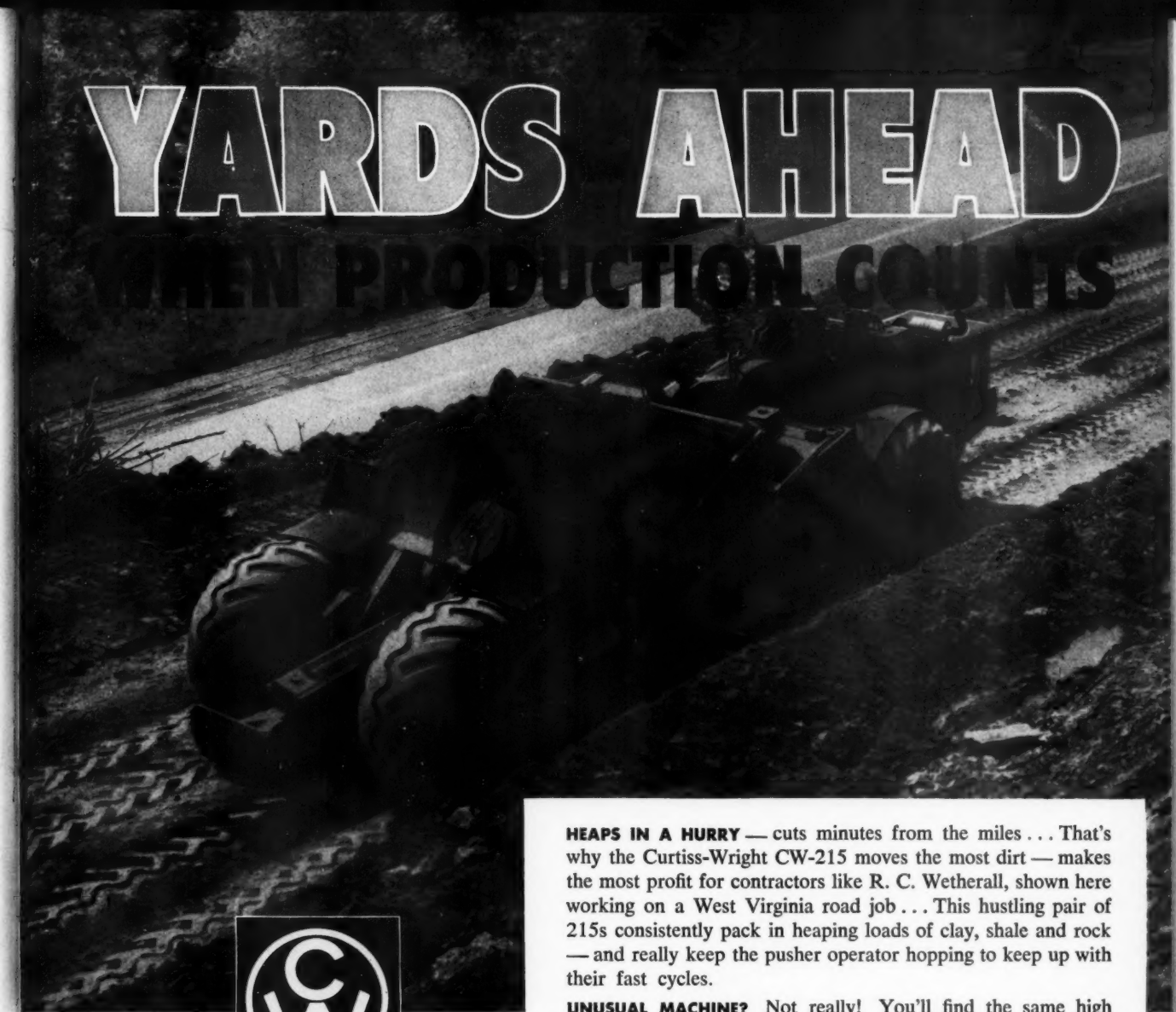

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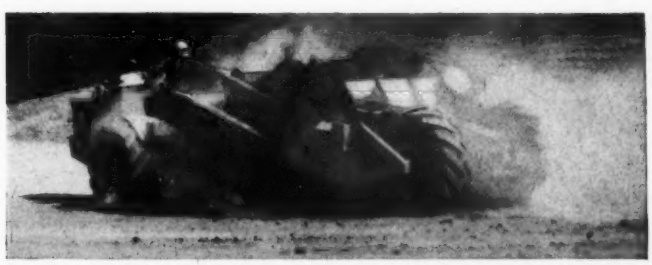

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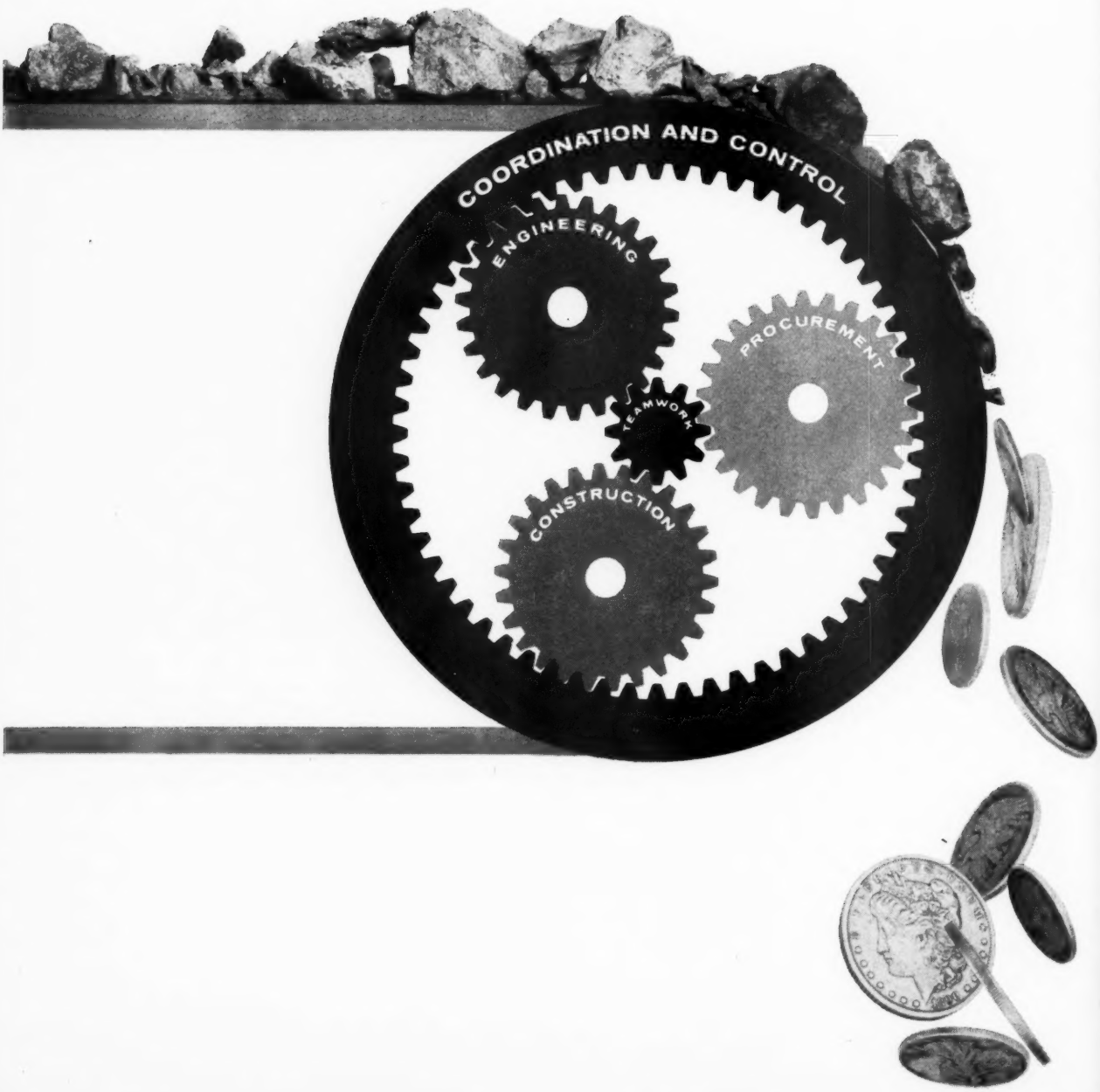
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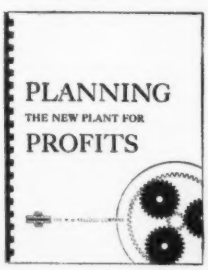

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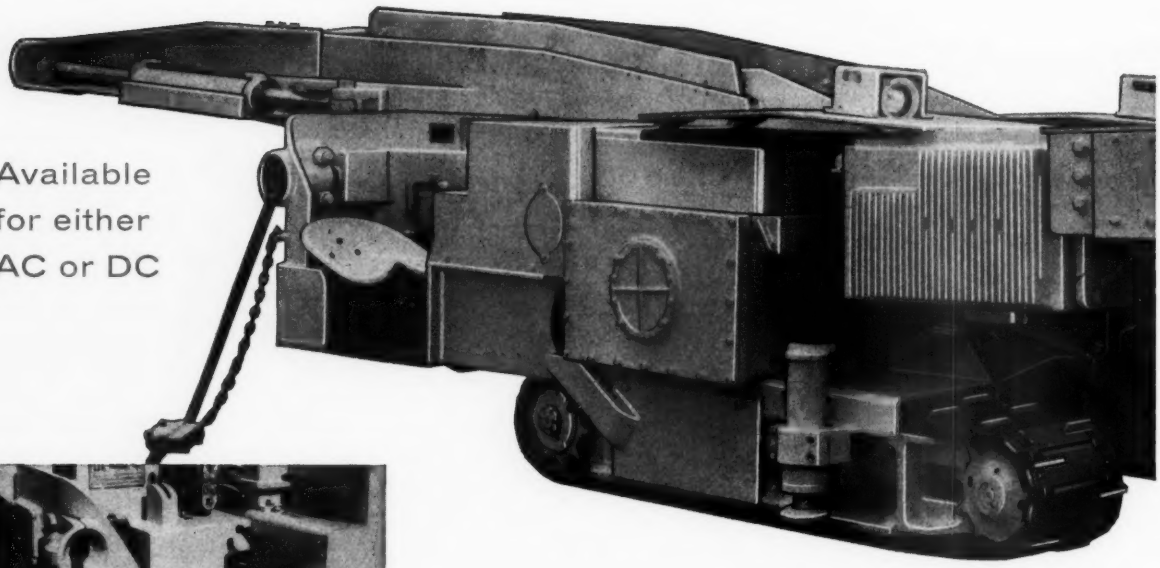

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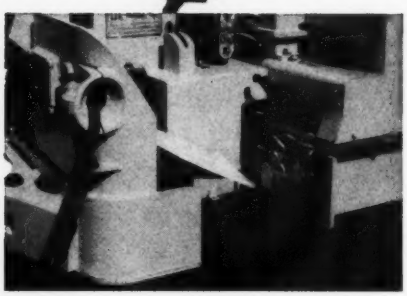

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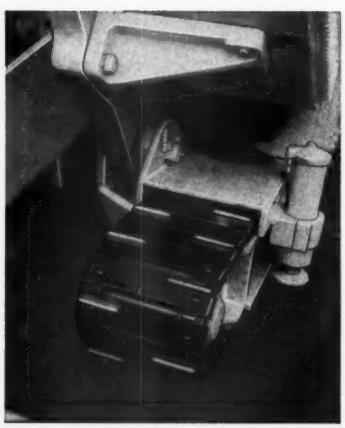

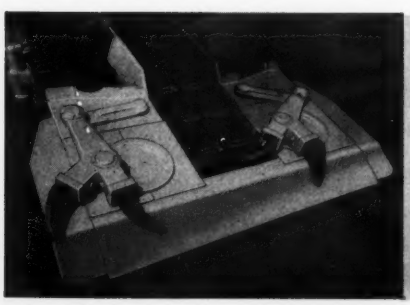

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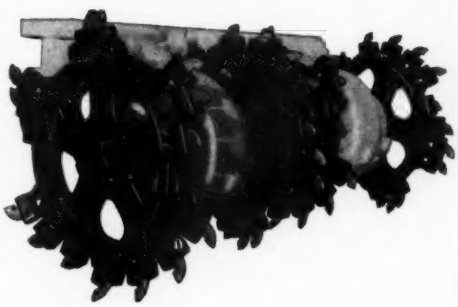

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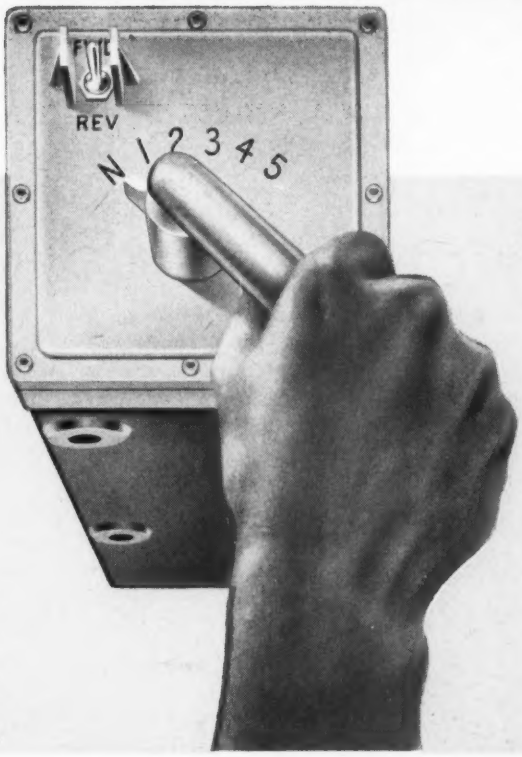

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SynchroTouch Transmission Control **uses hydraulics as a source of power and is activated and controlled electrically. When the desired gear is dialed, the following sequence occurs on an upshift in a split second:**

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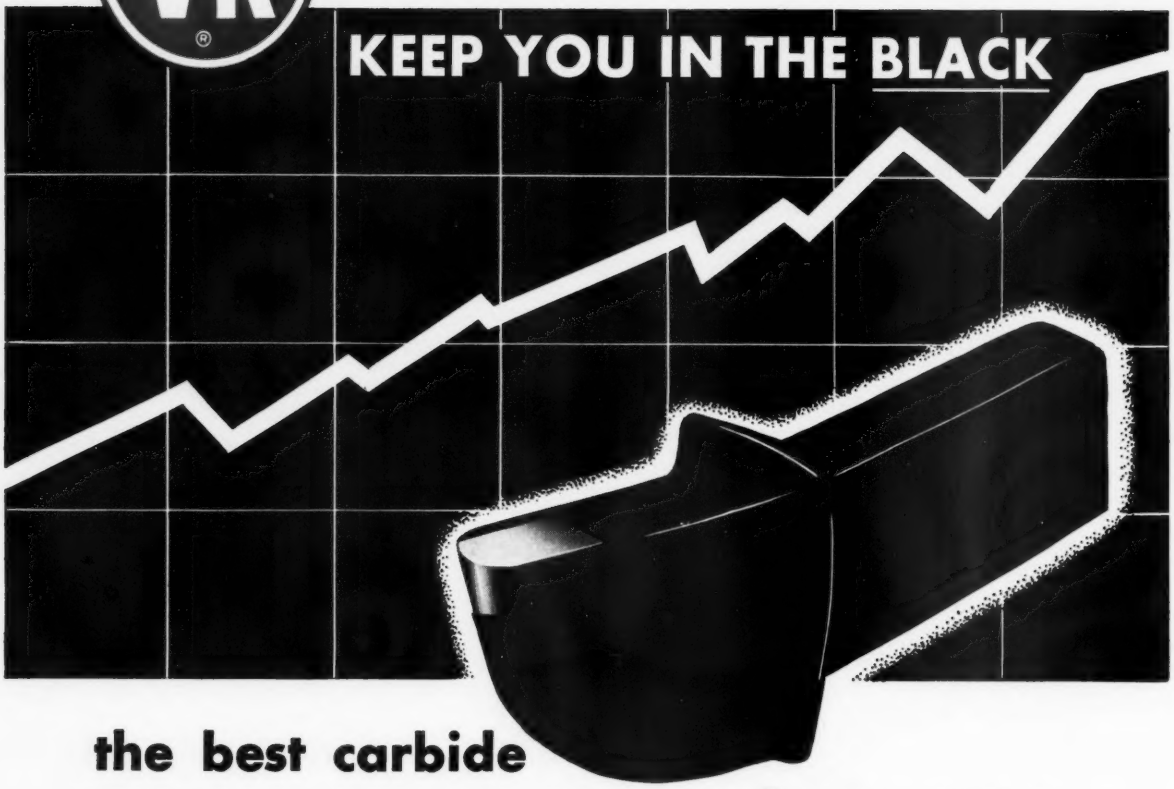

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When modernizing your pit operations, don't overlook the savings you can make by replacing 2 or more slow-moving track-type tractors with a fast, rubber-tired tractor, to handle your scattered pit and road clean-up. This *one* speedy tractor can complete the same (or more) assignments — without need for extra machines and operators.

These "sure-fire" savings are possible with a fast, rubber-tired LeTourneau-Westinghouse Tournatractor®.

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2. Between pit chores, your fast, rubber-tired tractor can handle haul-road maintenance and drainage problems. Good haul roads help to lower your hauler repair costs... keep these production units rolling fast and safely, to complete more cycles per hour.

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4. Cleans-up around plant area, dresses and seals stockpiles, eliminates excessive waste.

5. Tournatractor spots rail-cars, tows equipment — reduces costly time waiting for switch engines.

6. In winter, with V-type snow plow, L-W tractor plows snow from roads, loading and dumping areas — keeps pit operations open and safe in all kinds of weather.

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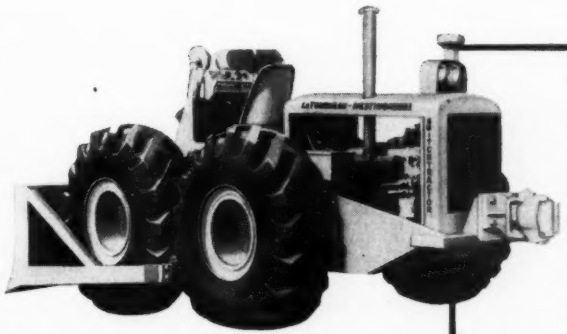
Let us demonstrate a LeTourneau-Westinghouse Tournatractor in your pit. Write or phone for complete information. No obligation.



Standard Type E railway car coupler is one of 10 Tournatractor attachments available to help you cut tractor costs. With coupler, this powerful off-track switcher spots and groups rail-cars fast. Big, rubber-tired wheels on SwitchTractor† straddle rails, ride on ballast and tie-ends — deliver double the tractive effort of steel-wheeled switchers on steel rails.

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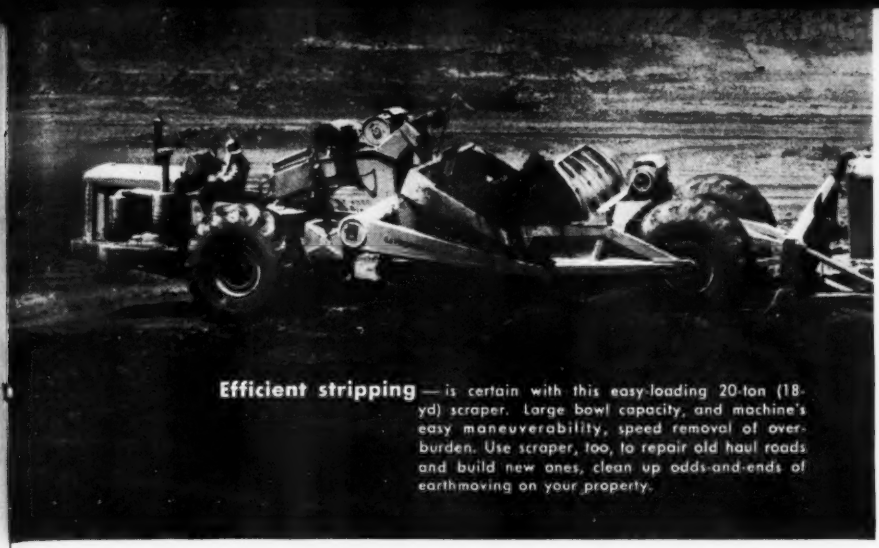
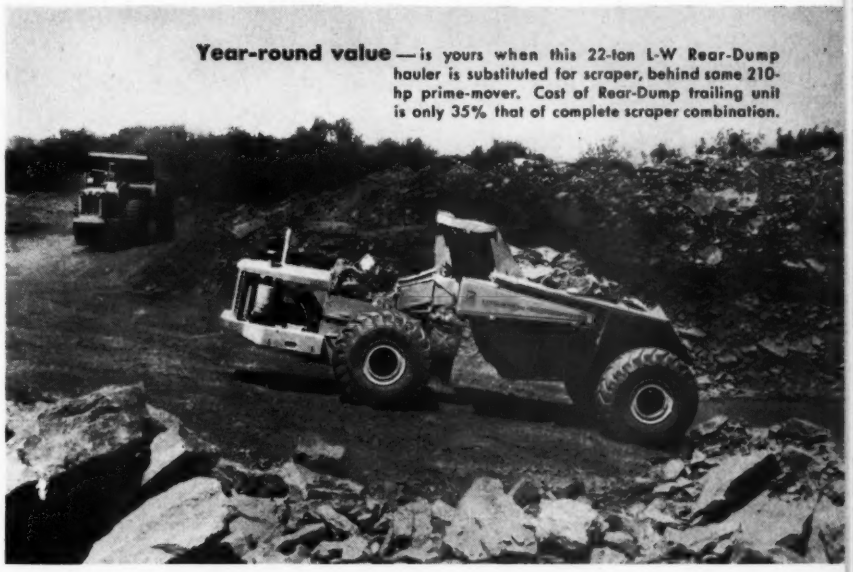


Efficient stripping — is certain with this easy-loading 20-ton (18-yd) scraper. Large bowl capacity, and machine's easy maneuverability, speed removal of overburden. Use scraper, too, to repair old haul roads and build new ones, clean up odds-and-ends of earthmoving on your property.

For shallow stripping, this scraper's your best bet

gives you year-round service with interchangeable L-W Rear-Dump



Year-round value — is yours when this 22-ton L-W Rear-Dump hauler is substituted for scraper, behind same 210-hp prime-mover. Cost of Rear-Dump trailing unit is only 35% that of complete scraper combination.

Time means money when you're stripping varying depths of overburden in your pit. If overburden is free of rock, and is shallow and wide-spread, crawler-type excavators — such as shovels, draglines and crawler dozers — move slowly to new work areas, increase your costs. Furthermore, they can only dig and cast . . . require other machines to haul spoil to out-of-the-way disposal areas.

Self-propelled scrapers move shallow, non-rocky overburden at lowest cost per ton. Since stripping is a periodic job, most scrapers are sidelined many days during the year because there is not enough steady work. Not so with LeTourneau-Westinghouse C Tournapull®. When you finish stripping, you simply interchange its 18-yd scraper for a 22-ton Rear-Dump trailing unit. Thus your 210-hp L-W prime-mover works productively for you all the year-round for greater profit.

Cost of the interchangeable hauler trail unit is only 35% of that of prime-mover and scraper combinations. Other interchangeable L-W work units include Bottom-Dump, Side-Dump, and Flatbed haulers.

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All off-road L-W Tournapull units have easy maneuverability for work in restricted quarters, instant electric control of all work functions. They have powerful brakes (largest in the earthmover field), dependable power-steer, and exclusive, power-transfer differential which keeps these machines working in soft going when other haulers bog down.

All-around usefulness, and interchangeability of hauled units make L-W 'Pull† a sound investment for your pit. Ask for complete specifications, and a demonstration.

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LW

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HARD HITTING CP-69 SINKER DRILL

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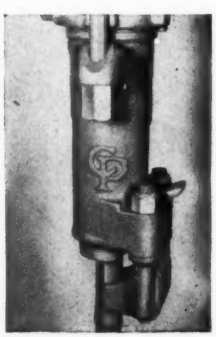
Airlegs, either integral or attachable type in 36″ or 48″ standard feed and a 72″ telescopic leg for special requirements is available. Write for complete data on the new CP-69 Sinker.

Integral telescopic airleg for CP-69 Sinker

Attachable telescopic airleg for CP-69 Sinker



Close-up shows Beaver Tail Retainer with latch closed

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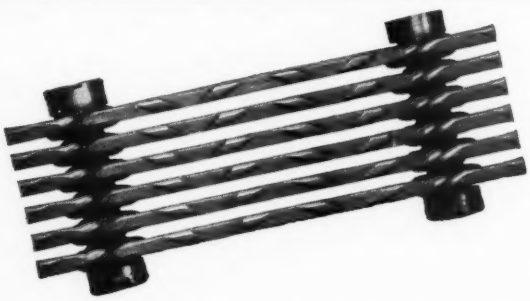

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EDITORIAL

ROBERT W. VAN EVERA, Editor

DECEMBER 1959

Politics Should Be People

In our complex society it is difficult to keep the various processes of Government in proper balance. To represent the electorate as the Constitution contemplates, our statesmen must be aware of their constituents' views. Conversely, these views must reflect a fair appreciation of governmental procedure.

Thomas R. Reid, civic and governmental affairs manager, Ford Motor Co., in a recent speech stressing the need to return politics to the people, observed, "It is a remarkable fact that the American people, for all their marvelous history of constitutional government, generally indicate so little political enthusiasm or even understanding of politics. . . . More often than not, we treat our heritage of freedom in pretty casual fashion."

We fully subscribe to this further statement by Reid: "Our overriding aim should be to restore strength and balance to our democratic practices by building up the health of both political parties. In short, our efforts must be directed toward restoring politics to the people."

We urge as many as possible of our readers to participate in political activities at the "grass-roots" level. There is a big job to be done in getting citizens to vote, but even more critical and more immediate than this is the groundwork that must be done before election time and before the campaigns begin. Candidates must be committed; platforms must be formulated; political strategy must be mapped out.

Political scientists have found a definite correlation between the number of party workers who get out and work at politics year around and the party that walks away with victories at the polls. Both major parties need help, and if we continue to "let George do it," we'll soon find that we have a Government which represents George's views and not our own — we sacrifice our right of self-government by default.

Teddy Roosevelt once said, "The governing class in a republic is composed of strong men who take the trouble to do the work of government; and if you are too timid, or too fastidious, or too careless to do your part, then you forfeit your right to be one of the governing, and become one of the governed instead."

Actually, most people who take part in political affairs find it extremely engrossing. There is social stimulation in working with like-minded people, to say nothing of excitement, inspiration and challenge. Most important, the individual political worker can take deep satisfaction in the knowledge that he is performing an immeasurably worth-while function for himself and his country.

Many corporations encourage and make specific allowance for their employes' personal participation in political and civic activities.

In doing so they place themselves at a substantial advantage and stand to retain not only their positions of community leadership, but their employes as well.

USBM Getting up to Date

Congratulations are in order to the U. S. Bureau of Mines for accelerating its publications work to get information to the public at the earliest practicable time.

A quickening of work output by any Government agency — or, for that matter, by any organizational unit of private enterprise — doesn't "just happen." We suspect that it took real teamwork at all levels in the Bureau to speed up work on important periodicals — advancing publication dates by as much as two years or more. Individuals at the Interior Building in Washington, others in field offices all over the country, and many industry men in the various branches of mining must certainly have been involved.

Publications which have been affected by this accelerated production program include the *Minerals Yearbook;* the *Mineral Market Summaries,* various *Bulletins* covering accident statistics and other subjects, and *Reports of Investigations* presenting research findings.

The *Yearbook,* with supplementary preprints of its many chapters, is particularly useful. Similarly, the production and shipment reports included in the *Mineral Market Summaries* are in constant use by industry. These summaries are published at intervals varying from weekly to annually, and of course, are far more valuable if received while they are still current.

The public is quick to criticize the shortcomings in Government — and rightfully so. We think it is equally important to recognize notable accomplishments — so we raise our hat to the Bureau of Mines.

Economic Evaluation of Proposed Mining Ventures

—a series of six articles covering the subject from initial exploration work through financing the enterprise. Parts III and IV are presented in this issue to be followed in a forthcoming issue by Parts V and VI

Part III—MINE PLANT AND PROCESSING PLANT CONSTRUCTION

By WILBUR JURDEN
President
Anaconda-Jurden Associates, Inc.

IN evaluating the economics of any mining venture where the tonnage, nature of the ore and location are such that a metallurgical plant is indicated, it is, of course, necessary to prepare an estimate of the cost. For strictly economic purposes in evaluating return from the investment, the estimate need not be as accurate as that which is required for the actual appropriation of money. As a matter of fact, it is almost impossible in preliminary surveys to make a really accurate estimate because there has been no time for research work, preparation of preliminary plans and the accumulation of data essential to the final estimate. Estimates required for this purpose, then, can be made quickly by an experienced office from costs of previous plants and from data compiled from other carefully prepared estimates on similar projects. Such an estimate should be somewhat on the high side but not excessively so. For all practical purposes, such data will serve just as well at that stage of the program as an estimate which might require months to prepare.

Accuracy Key to Success

If, then, the project is found economically attractive on the basis of these preliminary estimates and the construction of the mine works and metallurgical plant is authorized, we step into an entirely different phase of the work. An accurate detail estimate will have to be prepared and, for the success of the entire project, it is imperative that it be prepared with the smallest margin of error possible.

Unfortunately, a great many promoters and company officials have found to their embarrassment that it was necessary to refinance their program after construction work was well along, simply because the estimates were too low. Whenever this occurs, and it is a common occurrence, it tends to create skepticism on the part of financiers and company officials towards all estimates and frequently brings forth the rather caustic remark that "if we double our engineer's 'guesstimate,' we may have enough money."

It is not the author's intention to elaborate the innumerable reasons why misleading estimates are frequently produced, but it might be said that inexperience and lack of accurate cost data are two of the main contributing factors. The point to be stressed, however, is that an engineering organization with the proper background of experience, accurate cost data from previous projects, all other data pertinent to the preparation of an estimate plus the integrity and courage to tell the owners what the job is going to cost before they start construction, regardless of influence or consequences, can prepare an estimate just as accurately as they can perform any other phase of engineering work.

Estimate Based on Flow Sheet

It should be emphasized here that the engineering office charged with the responsibility of preparing, first, the preliminary estimate and, second, the final or appropriation estimate, should never be influenced either by the preliminary estimate or by the hope of officials that the final estimate will be considerably lower than the preliminary. In the first place, the preliminary estimate can miss its mark by a wide margin without having too great an effect on the economics of the over-all project. Also, when a preliminary estimate is made it is usually impossible to obtain all of the pertinent data which are essential to the final or appropriation estimate. Such data are, first of all, an accurately prepared metallurgical flow sheet based upon thorough research or pilot plant work. This is the starting point, and if this flow sheet is reliable drawings can be prepared

for estimating purposes and calculations can be made for the quantities of concrete, steel and equipment going into the plant.

Along with this, however, it is necessary to obtain accurate data pertaining specifically to the location of this project. Data must be gathered on soil conditions, topography, weather conditions, transportation to and from the plantsite, power supply, water supply and labor supply. The last four items are in one category for the construction period and a different one after the plant is in operation, but both have an effect on the estimate. Then, of course, depending upon the type of plant, there is the question of tailings disposal, gas emanations, treatment of acid waste, housing and townsite facilities required, shops, offices and change house facilities, rail and ocean freight, import taxes, welfare expense and engineering costs—and don't forget interest on borrowed money during the construction period as well as starting-up expense, both of which can be considerable items.

Assuming that an office is provided with all of this information, if they are not experienced in utilizing it to the best advantage, the result can be tragic. The forms used and the methods developed for compiling and accurately pricing quantities are just as important and vital to the successful completion of an estimate as any of the other factors mentioned in the foregoing. It might be added that the preparation of one of these estimates for a large project requires thoughtful and meticulous work on the part of a number of men for many weeks and sometimes many months. Anyone who attempts to rush through a document as important as this is only courting trouble.

Estimating Highly Specialized Work

Also the type of men employed on this work is most important. Estimating is a specialized form of work and calls for a type of man who is peculiarly fitted by training and aptitude to perform it. The author has seen the best of designers fail completely when they attempt to do estimating work, and he would have no confidence in any estimate unless prepared by a department trained for and devoting all of its time to this class of work. If, then, an office is too small to maintain a department of appropriate size, they would save themselves a great deal of trouble by taking their problem to a firm with an experienced estimating department and an established record of past achievement.

As an example of the results that can be obtained by following this procedure, the writer might cite the recently completed El Salvador project. The plant was divided into its numerous components with a separate appropriation estimate for each one. By this process 132 detail estimates totaling more than $80,000,000 were prepared which required the work of seven men for 44 weeks. Possibly this appears to be a slow process to some people, but to those providing money for the project, the results were highly gratifying because final costs were approximately two percent below the estimated costs.

Although this is remarkably close, on this particular project Anaconda Jurden Associates was favored with all of the desirable factors such as a highly skilled engineering organization, a carefully prepared estimate and an exceptionally efficient construction department, no strikes, no interferences and no serious delays. Under such conditions there is absolutely no excuse for over-running an estimate or for prolonging the construction schedule. Of course, such desirable conditions do not always exist, but it might be added that a recent compilation on eleven jobs, covering copper production, aluminum, uranium, iron ore and manufacturing plants and totaling nearly $600,000,000, showed an average error of 2.13 percent between the actual appropriation estimates and the completed projects. This fact confirms the statement that appropriation estimates can be accurately prepared given the proper engineering experience, the proper data and the time required.

Good Timing Essential

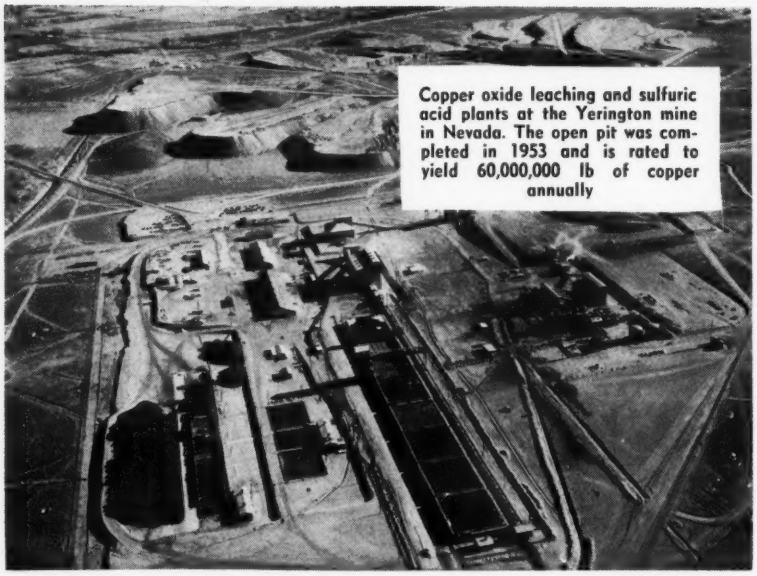
Now, assuming that a reliable estimate has been prepared and construction authorized, it is essential that the owners be advised as accurately as possible of the time required to complete the project and the starting-up date of operations. When this date is established, the owners should be advised of the cash requirements for regular intervals—three or six months—covering the whole construction program. This information having been presented, it becomes the responsibility of the engineering office to maintain such accurate control over every phase of the project that the starting-up date can be maintained or bettered. It is, of course, possible for an experienced engineering office to make a time estimate before actual construction work is started, but this original estimate is more in the category of the preliminary cost estimate. A definitely positive construction schedule cannot be prepared until a considerable portion of the equipment has been purchased and until it is known when the structural steel will be erected.

On some of our jobs, especially during and following the war, the construction period exceeded the actual estimate, but in most cases the original schedule was improved upon after the date of structural steel erection had been accurately determined, especially on the larger projects such as Yerington, Erie Mining Co. taconite plant, the El Salvador plant and the Columbia Falls aluminum plant.

Expedite Purchases

A construction job can be slowed down and drag for a great many

The Columbia Falls, Mont., aluminum reduction plant, Anaconda Aluminum Co. Each of the four potline buildings is 1080 ft long. The plant, which was completed in 1955, has an annual capacity of 120,000,000 lb



Copper oxide leaching and sulfuric acid plants at the Yerington mine in Nevada. The open pit was completed in 1953 and is rated to yield 60,000,000 lb of copper annually

reasons, but here again the experience of the engineering office is most valuable in anticipating and avoiding many of the causes for delay. They must have the knowledge to properly organize the work in the designing office in such a way that first things come first, in order that construction can be proceeding in an orderly manner while drafting room work is progressing. Requisitions for material and equipment must also be prepared in the proper sequence and expedited by the engineering department from the day they are sent to the purchasing department until a satisfactory purchase is completed.

In the meantime, strict control must be exercised over the cost of purchased equipment and comparisons made with the detail estimate before any important purchase is completed. Here again the method of preparing the detail estimate becomes important for it must be tabulated in such manner that these comparisons can be readily and accurately made without delay.

Another important control is set up by close cooperation between the chief estimators and the chief designers. A good estimator can recognize a design which might be far more elaborate and expensive than the one on which he estimated. This situation occurs frequently for it is difficult to make the designers follow the estimate drawings, but once these items are called to the attention of the chief engineer the design can usually be corrected without entailing an over-run of the estimate.

Follow Up on Purchases

Assuming then that the design and purchasing are progressing satisfactorily and within the estimate, it becomes important that the expediting and inspection department, working in close cooperation with the field engineer, follow up and inspect all items by personal contact in the manufacturers' plants. Part of this job is to see that unnecessary delays do not occur and that the equipment is built and tested according to specifications and arrives on the job in an operative condition. Failure in this important function can cause serious delay and disorganization in the field resulting in costs which may exceed the estimate.

And now we come to the actual construction in the field. Regardless of how well the preparation of drawings, purchasing, expediting, etc. have been carried out, a state of utter confusion can be created if an incompetent and inexperienced crew is employed.

No estimator could ever allow enough money for an over-run that would be caused by such a situation. We all know that this can and has happened, and when it does the estimates for both time and money are certain to be exceeded. It is, therefore, incumbent upon the engineering office to organize field work in such manner that it will function with the greatest degree of efficiency and this can be accomplished only by an organization composed of experienced personnel.

Project Engineer Needs Authority

First of all it is imperative that a competent and experienced engineer be put in charge of the project and that he have full authority. It is seldom that the field engineer can organize the actual construction work; but on occasion this has been done, especially in places where for some reason or other a contractor could not be brought in. When a contractor is employed for actual construction work, the engineering department must be sure that he is one who has an organization available and experienced in this class of work. Obviously, it can be very costly to educate inexperienced supervisors who often become frustrated because of their inability to grasp the problems involved. The labor crews are quick to sense such incompetence and the result is a slowdown with attendant high costs which exceed the estimate.

There must, of course, be complete cooperation between the contractor and the field engineering staff, but the field engineering staff must of necessity set up measures of control over progress and costs. In this connection, one of the most important steps is to establish an accounting department which will set up the construction costs in such form that the construction engineer can utilize them as frequently as necessary, thus enabling him to constantly compare the costs with the money appropriated in the estimates. Given a competent engineering organization, this can be readily accomplished, but it is no place for an amateur and many officials have found out to their sorrow that the cost of inexperience and ineptitude can be very high. Here, as in all other phases of an engineering project, there is no substitute for experience.

The foregoing depicts an ideal setup which is designed, first of all, to produce an accurate estimate and, second, to see that construction is carried out in accordance with that estimate. Unfortunately there are a great many items which have a direct bearing on the progress and efficiency of a construction program and can cause it to drag. First is the question of delivery of equipment, structural steel, cement, etc.; second, the availability of labor; third, the experience, background and integrity of the engineering organization undertaking the project and fourth, the availability of additional draftsmen as required.

Construction Scheduling

Under conditions as they exist today it is not difficult to prepare a fairly accurate construction schedule for materials and equipment are all available on reasonably reliable delivery promises. Good construction crews are not difficult to obtain and

an established engineering office can be augmented by the employment of additional draftsmen without serious delay.

Unfortunately these conditions do not always prevail. During and immediately following the war delivery of material and equipment was very slow—large structural steel jobs required two or more years for delivery, and in many cases cement was almost impossible to obtain. Likewise, construction crews were difficult to organize and a great many men of inferior ability were of necessity employed on these jobs producing results commensurate with their ability. Available draftsmen were so scarce that manufacturers were unable to furnish the engineering office with certified drawings, with the result that checked drawings could not be produced for the field.

All of these factors had a very decided influence on the tenure of any construction project, and during these years it was impossible to make an accurate construction schedule or to deliver the equipment to the job in the proper sequence for the most economical procedure. Obviously, conditions like these can have a disastrous effect on any estimate which has been prepared for normal procedure, and when it is seen that the construction period will enter into adverse circumstances such as war, scarcity of materials, etc., then the engineer should attempt to advise the owners of the extra cost which will be involved.

Of course, it is incumbent upon the engineering department to be constantly on the alert in order to compensate for as many of these delays as possible, but even so it is very difficult to prepare a time estimate which can be strictly adhered to when delivery of important equipment is so often postponed for reasons which are probably beyond the control of the manufacturer, and certainly beyond the control of the engineering department.

Flow Sheet Changes Can Be Costly

Another factor which can seriously affect the construction schedule is the injection of changes in the flow sheet upon which the project was originally based. Coming as they sometimes do, when drafting room work, purchase of equipment and construction are well under way, these changes can set progress of the plant back for months, especially if they should involve equipment entailing slow delivery. This is not only very costly but will ruin the best of appropriation estimates and the time lost can never be regained.

It has never been the function of our office to question the advisability of making changes after a job has started as we do not deal in research. But it is incumbent upon any engineering office, when such a change occurs, to advise the officials as to just what the change entails. When all the facts are brought to the attention of the proper officials, it is often found that the benefit to be derived from the contemplated change will not compensate for the delay and expense involved. However if it is decided to make the change the officials will at least have been acquainted with all the facts before making the decision.

Another item of delay which cannot be estimated is the menace of strikes. These, of course, do irreparable damage to any construction job. If the estimator attempts to take this item into account in either time or money it would make the estimate look ridiculous, but the parties responsible for financing the project should realize that such hazards do exist and are beyond the control of the engineer responsible for the design and construction.

Anticipate Delays

About the time when everyone feels satisfied that the construction work is progressing very nicely and on schedule, the inevitable question begins to assume its ugly form in the minds of not only the officials, but in the minds of the engineers and operators as well, and that question is: "Will the plant start and build up to rated tonnage on schedule, or are we going to encounter long and expensive delays in making changes before we can get into production?" This contingency, of course, is something that no estimator can honestly cover and to say that such things do not happen would be absurd.

Errors, of course, can creep into any project for which thousands of drawings must be made in the design office which, in turn, very often depend upon hundreds of manufacturers' detail drawings. They can also originate in the research work upon which the flow sheet and design are based, or can creep into the actual field work. All of these things can happen and do happen, sometimes becoming cumulative, but as a rule an experienced engineering office with sufficient ingenuity can compensate for most of them without serious delay to the project, but if we add the element of inexperience the result can be very expensive.

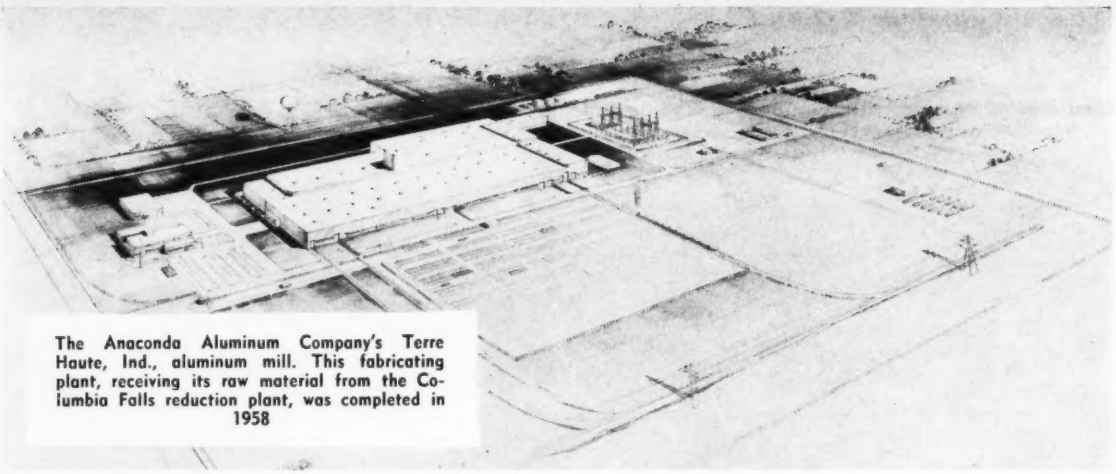
The most dangerous element is the inclusion of untried or experimental design and the inclusion of equipment which, while appearing attractive, has never been thoroughly proven in practice on a similar project. Here again the experience and background of the engineering office is invaluable. Engineers who adhere to a strict policy of basing designs and layouts on experience obtained from other successful projects, and follow up with the determination to prepare all detail drawings in the same manner, will save the owners a great deal of worry and can be of tremendous aid to those who are responsible for financing the project.

When Anaconda acquired the Chile Exploration Co. and embarked on an expansion program in 1925, the number one complaint of the operators was that the engineers in New York had sent them equipment for the original plant, which was flimsy and entirely unsuitable for the rugged service. Constant equipment failures seriously delayed the operation at Chuquicamata, and before Anaconda took over several years were spent trying to attain rated production. As a result of observations at that plant over thirty years ago, the author adopted the slogan "Never put a piece of equipment into a large project until it has been thoroughly proven in practice." Although there has been criticism for following this policy, especially from salesmen, the results have been most gratifying to all concerned. If strictly adhered to it saves time and money for the owners and is a great factor in building a plant that operates.

Operating Efficiency

There is still one other item which is important in the evaluation of a project, and that is operating efficiency. This refers principally to labor, although the mechanical equipment must also be selected and installed in such a manner that it will operate with the greatest efficiency and a minimum of repairs. Operating labor, however, is the big item and one which must be kept in mind during every stage of the design.

The subject of automation, of course, is now foremost in the minds of all engineers and operators, and the principles can be utilized to a great extent in various types of metallurgical and industrial plants. However, this can be carried too far for all such equipment is expensive to install and might require so much maintenance that the over-all saving



The Anaconda Aluminum Company's Terre Haute, Ind., aluminum mill. This fabricating plant, receiving its raw material from the Columbia Falls reduction plant, was completed in 1958

would be negligible. Aside from automation, however, there have been many advances in types of equipment and methods of installing such equipment which, if properly used and evaluated, can effect a considerable saving in manpower, and this fact has become increasingly evident during the past twenty years.

Labor Saving Devices

On the subject of labor, there was a time when it was not necessary to give labor saving devices much consideration. When Mr. Klepetko built the original Anaconda plant in 1902, probably very little thought was given to labor saving, and in 1926 when the Andes plant was built at Potrerillos, Chile, labor was cheap and plentiful. However, when the Morenci plant was erected in 1940, labor saving was of paramount importance and a number of innovations were made at that plant which effected considerable economy in this respect—so much so that the tonnage produced per man day from crushing plant to smelter was approximately two and one-half times as great as the tonnage per man day produced at the original Andes plant. This, of course, has a very important bearing on the economics of any venture for with the thin margin of profit existing on many projects, the operating cost of the metallurgical plant may be the deciding factor between profit and loss.

Therefore, the plant must be built in such manner that it will start operating when construction is completed, getting up to full production as rapidly as possible, and at full production, operate with a minimum of labor, power, repairs and maintenance. The El Salvador project which went into operation in April of this year, is the latest and most outstanding example of this requisite. Here we have a plant which started operating the day after construction was finished, and by taking advantage of thoroughly modern design and equipment it is estimated to produce nearly four times the tonnage per man day of the original Andes plant.

Design of 1926 Versus 1959

The Andes plant was probably the last word in plant design when built over thirty years ago, but with the El Salvador plant now operating only a few miles distant, there is a striking contrast between the most advanced methods of 1926 and 1959. In general, the plants are similar, but in mechanical and electrical details and the type of machinery installed, the two have very little in common. For instance, the crushers, conveyors, ore bins, grinding units, flotation machines, lubrication systems, dust control, power distribution and even lighting only bear a faint resemblance to each other in the two plants. However, this article is not intended to deal with mechanical details but only with the problem of evaluation, and on that particular subject the two plants have a great deal in common for in both plants, the officials had been presented with an honest, well-prepared estimate before the projects were started—the plants were both completed within the estimate in less than the scheduled construction period and both operated successfully from the start.

In the writer's opinion, the attainment of similar results should constitute the paramount objective of all parties concerned, for they have a tremendous bearing on the evaluation of a project, and are far more important to the officials and financiers than any of the multitudinous details involved from the inception of the project to its completion.

Part IV—FINANCIAL PROJECTIONS TO DETERMINE ECONOMIC FEASIBILITY

By A. BRUCE MATTHEWS
Partner
Arthur Anderson & Co.

THE role of the accountant is created primarily by the need for assembling in logical order and in understandable form all of the facts concerning the proposed mining venture. This information is required by the representatives of the money market in order for them to take positive action toward financing the venture. The author has seen a number of deals, which have been previously turned down for financing, receive favorable consideration by bankers and other representatives of the investing groups merely by reassembling the data previously available

in a form which proved that the proposed deal did merit investigation.

This article is intended to cover the broad principles which should be followed in preparing financial projections to determine the economic feasibility of a proposed mining venture. This will embrace the information required to begin such a projection in a typical integrated mining and milling situation and a limited discussion of the type of report which the writer has observed to be most helpful in getting the real story over to potential investors.

While the author's experience has been in the role of an independent accountant, the procedures to be suggested apply equally to financial projections which may be prepared by the financial executive of a company seeking investment capital, or by investment bankers representing a mining company which is attempting to raise capital for a new mining venture.

Accountant Must Be Realistic

The accountant's role demands that he be completely realistic and objective. He should attempt to treat the proposed venture on a factual basis and not become enamored with the romance of the particular project. The mining industry, like all natural resources industries, by its nature attracts many people who, while sound in their technical work, are gamblers and dreamers and this is as it must be. The many disappointments that a mining man encounters during his career make it necessary for him to have these two characteristics. It is easy for accountants and others associated with the mining industry in a side-line position to be bitten by the same bug. However, if we do and thereby lose our ability to consider the cold facts of reality, our usefulness to the project ends. Financial analyses and forecasts must be based on facts which can be completely supported, and weaknesses in the presentation which cannot be overcome due to lack of sufficient information must be disclosed if a fair presentation is to be made to potential investors.

The process of bringing a proposed mining venture into being involves a team composed of many experts—geologists, mining engineers, metallurgists, legal counsel, financial advisors and accountants. In order to obtain successful financing, this team is again put to work. It is extremely important that as many of them as is practicable be independent consultants, since this independence can add considerably to the weight attributed by potential investors to the final presentation.

All Facts Must Be Known

Consider the type of information the accountant requires to prepare the financial projections. Detailed information regarding mineral rights involved in this proposed mining venture is required including title opinions as to the mining properties involved. The accountant should also determine the extent to which royalty interests, net profits and other similar interests exist with respect to the property.

Information is needed regarding: ore reserves, including quantities of ore classified by grade or value of content; amenability of ores to the proposed milling processes; and mining characteristics, upon which the decision as to the mining method can be based, including continuity of the ore body and its depth, nature of overburden, overburden ratio, etc.

The accountant must have complete information regarding mining costs to investigate the possibility and costs of having the mining done under contract versus the company carrying on its own operations. He should consider and discuss with the mining engineers all possible or probable mining problems including such things as mine flooding. Also, he should obtain information necessary for forecasting the cost of mining by company personnel including labor force, equipment and other requirements. He should investigate the labor market and union activities in the area, particularly in the event the company is proposing to operate on a non-unionized basis. The situation with respect to housing the miners and alternative arrangements which may be made, together with relative costs, should be studied.

Equipment costs should be obtained and supported either by bids or quotes which may be obtained from suppliers. In addition, alternative methods of financing equipment through the use of equipment obligations and through other means should be determined. Maintenance costs should be obtained so that projections can be made as to this relatively significant item.

Data with respect to utility services should be obtained including the alternative costs of producing electric energy and other necessary utility services at the site, as compared to obtaining comparable service through line extensions from utility companies serving the area. The situation with respect to stockpiling ores should be investigated and information as to maximum quantities that may be stored and any location problems involved should be studied. Ore haulage —whether by company operated equipment or by contract—should be considered. The need for and the cost of road construction and maintenance must be determined.

Cost of Milling Facilities

The nature of the proposed mining venture will determine whether or not it logically must include milling facilities. However, the accountant must investigate the possibility of and cost of having ore custom milled, as compared to construction and operation of the company's own facilities. All possible or probable milling problems should be taken into account, including start-up problems, attaining adequate recovery factors, etc.

Cost of mill construction should be considered and data obtained from proposals which have been received by the company, or from industry data in the event proposals are not yet available. Costs of operating the mill, including all major elements, must be determined. Inventory levels required for raw ore, ore in process, supplies, spare parts, and finished products must be investigated. Consideration must be given to whether or not the proposed mill will accept custom ore and the probable revenues which may be produced from this phase of the company's operation.

Projections of the administrative and clerical force as well as general and administrative expenses must be made. This may be difficult in the case of a new operation, but they can be estimated with reasonable accuracy.

Product Market

Depending upon the type of ore to be mined and processed, a market survey should be made to support the assumptions as to quantities of product which may be sold and the prices which can be realized. Obviously, the soundest venture will have some strong indication of product saleability in the form of sales contracts or intentions to purchase before the venture gets under way, particularly because of volatility of prices in the metals markets. The terms of sale and the expected period from date of shipment to date of collection must be determined to aid in forecasting working capital requirements.

A complete survey of the Federal, state and local tax situation applicable to the venture must be com-

pleted. This is extremely important, and such questions as the method of computing percentage depletion must be determined, since taxes have such a substantial effect upon the economics of the proposed mining venture.

Consideration must be given to whether the company should be operated as a corporation, partnership, joint venture or some other form of business organization. Due consideration should be given to the potential liabilities, the effect of Federal and State income taxes, and other factors.

Net Income Projection

Exhibit I is a simplified net income projection based on the assumption that a five-year period would be adequate for the purpose of displaying the results of operations. The significant categories of income and expenses are listed down the page with the figure for a given year shown opposite in the appropriate column, and a total column for quick reference to the aggregate picture of the five years' operations.

The captions shown here should contain parenthetically the significant details relating to the basis for each of the items projected. For example, the basis for the projection of sales should be shown parenthetically after the caption "Sales," and should include such information as the amount of metal or concentrate to be sold together with the price per unit upon which the projection is based.

In the detailed report accompanying the forecasts and projections, the basis for such estimate should be discussed including complete information on sales contracts which have been executed; or for which arrangements have been made; or expectancy as to orders which will be received for the company's product. The basis for the price, and the possible range of prices which might be expected, together with the effect upon net income, should also be included in the commentary accompanying the exhibit.

Detailed Ore Costs

The cost of ore is broken down in this exhibit as between company ore and custom ore. Information such as the ratio of company ore to total, mining cost per ton together with the basis for such estimates, haulage costs, royalty interests and recovery factor should be shown parenthetically and discussed in detail with the proper support in the report.

Similar information with respect to the custom ore should be given; including in addition, the price expected to be paid for the ore with references to contracts or negotiations existing at the time the projection is prepared. The projected cost of milling should include a reference to the average cost per ton of ore to be milled, and the basis for this cost discussed in detail. References to the consultants' reports and complete information as to the basis for the milling cost estimates should be reported.

With respect to depreciation, the total cost of the depreciable facilities should be disclosed together with the basis for such depreciable property costs—method of depreciation, average life and salvage values should also be revealed.

As for depletion, the method of writing off the cost of the ore body should be set forth together with information pertaining to cost of the leases. Future exploration and development costs to be amortized should be detailed with sufficient support so that the reader can be fully informed about the depletion expense.

The cost of officers' salaries, maintaining the general office, insurance, purchasing, accounting and other general and administrative expenses should be set forth in the commentary in detail. The compensation of key officers is of considerable interest to proposed investors and this should be clearly disclosed, since there is surely a question that will be raised in the event no mention is made of this item.

Amortized Expenses

There are a number of expenses which might be deferred for accounting purposes; they are included in exhibit I under pre-operating expenses. Generally, a considerable period of time will elapse between the first expenditures on a new project and the time that operations begin. Such costs as are incurred prior to the commencement of operations are recorded as deferred charges and are chargeable against future operations. Other items of a similar nature are deferred stripping costs, and deferred debt discount and expense.

General taxes should be set forth in some detail in the report with a description of the basis for making the estimates, particularly with respect to severance taxes and ad valorem taxes.

Interest expense should disclose the expected rates to be paid on bank loans and long term debt, together with the payment schedule anticipated. This is extremely important in the event that the proposed investors are not agreeable to the terms suggested in the projection, since this would give them the information necessary to compute a different interest cost based on a set of facts deemed to be more realistic.

Taxes and Depletion

Comments with respect to Federal and state income taxes should include an estimate of future rates based upon the rate at the time of making the projection, unless some information is available indicating the rates will be different. The basis of computing statutory depletion should be discussed in the report since it is not entirely definite as to the proper method of computing percentage depletion with respect to certain minerals due primarily to the definition of the first commercially marketable mineral product.

Generally companies will elect to take advantage of accelerated methods of depreciation, and in some cases the facilities may be certified as emergency facilities permitting a write-off over a 60-month period. If these methods are used and if they differ from the depreciation methods used in preparation of the financial statements, the question of deferred taxes will arise and the method of handling deferred taxes should be clearly disclosed for the reader.

When this exhibit has been prepared, the reader will have before him a projection of the net income of the venture for each year of the five-year period, together with the total net income set forth in the last column.

This exhibit provides the beginning point for the preparation of the next exhibit which is cash flow projection. It also tells the proposed investor what the earnings will be during the period. This in turn will give him some indication as to the possible value of the company's common stock during this period and therefore will be useful to the investment banker involved in placing the company's common stock.

Cash Flow Projection

Exhibit II is probably the most important statement in the eyes of the potential investor. It shows, for the same five-year period, cash at the beginning of each period, source of funds provided, including the net income of the company to which is added the non-cash expenses—depreciation and depletion and pre-operating expenses being amortized—to arrive at net cash income for each of the years.

EXHIBIT I

MINING VENTURE, INC.

Net Income Projection
Five Years 1960–1964

(000's Omitted)

	1960	1961	1962	1963	1964	Total
INCOME:						
SALES	$10,000	$10,000	$11,000	$12,000	$12,000	$55,000
DEDUCTIONS FROM INCOME:						
COMPANY ORE, including amortization of deferred exploration and development	$ 2,200	$ 2,200	$ 2,640	$ 3,280	$ 3,280	$13,600
CUSTOM ORE	3,500	3,500	3,500	3,500	3,500	17,500
COST OF MILLING	2,000	2,000	2,100	2,200	2,200	10,500
DEPRECIATION	640	640	640	640	640	3,200
DEPLETION	75	75	90	105	105	450
GENERAL AND ADMINISTRATIVE	175	175	175	175	175	875
PREOPERATING EXPENSES, being amortized over the life of the venture	105	105	105	105	105	525
GENERAL TAXES	70	70	80	90	90	400
INTEREST EXPENSE	265	190	115	40	—	610
	$ 9,030	$ 8,955	$ 9,445	$10,135	$10,095	$47,660
Net Income Before Taxes	$ 970	$ 1,045	$ 1,555	$ 1,865	$ 1,905	$ 7,340
FEDERAL AND STATE INCOME TAXES	340	365	545	655	665	2,570
Net Income	$ 630	$ 680	$ 1,010	$ 1,210	$ 1,240	$ 4,770

EXHIBIT II

MINING VENTURE, INC.

Cash Flow Projection
Five Years 1960–1964

(000's Omitted)

	1960	1961	1962	1963	1964	Total
CASH AT BEGINNING OF PERIOD	$ —	$1,435	$1,845	$1,890	$2,840	$ —
SOURCE OF FUNDS:						
Net income (Exhibit I)	$ 630	$ 680	$1,010	$1,210	$1,240	$ 4,770
Add noncash expenses—						
Depreciation	640	640	640	640	640	3,200
Depletion	75	75	90	105	105	450
Amortization of exploration and development	1,700	1,700	2,040	2,380	2,380	10,200
Preoperating expenses	105	105	105	105	105	525
Net cash income	$3,150	$3,200	$3,885	$4,440	$4,470	$19,145
Sale of equity securities	1,000	—	—	—	—	1,000
Bank loans	200	—	—	—	—	200
Sale of debt securities	4,000	—	—	—	—	4,000
Total funds provided	$8,350	$3,200	$3,885	$4,440	$4,470	$24,345
APPLICATION OF FUNDS:						
Acquisition of mining claims	$ 450	$ —	$ —	$ —	$ —	$ 450
Exploration and development of mining properties	2,040	2,040	2,040	2,040	2,040	10,200
Plant construction	3,200	—	—	—	—	3,200
Working capital	500	—	—	—	—	500
Payment of bank loans	200	—	—	—	—	200
Payment of debt	—	750	1,800	1,450	—	4,000
Preoperating expenses, to be amortized over the life of the venture	525	—	—	—	—	525
Total funds applied	$6,915	$2,790	$3,840	$3,490	$2,040	$19,075
CASH AT END OF PERIOD	$1,435	$1,845	$1,890	$2,840	$5,270	$ 5,270

Other funds are to be provided from the sale of equity securities, bank loans, and debt securities, all of which will be coming in during the first year as demonstrated in this exhibit. The exhibit summarizes the company's plan of raising capital. In the detailed report, proposed terms relating to the various securities would be discussed including interest rates, payment schedules, important covenants, rights of the various classes of securities in the event of liquidation, etc. The source of outside funds is added to cash generated internally from operations to arrive at the total funds provided.

The next section of this exhibit sets forth the application of funds for such items as the acquisition of the mining claims involved in the specific venture. The report should discuss the claims in some detail including to whom payments will be made and pertinent information concerning what is presently know about the particular properties. Cost per ton of known ore, additional exploration and development costs which must be incurred and other similar information would be included in the report with respect to the mining claims.

The next item would be construction costs for the plant and housing, if company housing is required, and related facilities. The report would set forth in detail the basis for these estimates desirably referring to bids or negotiated contracts and engineers reports.

Working Capital Needs Often Underestimated

The amount of funds required to be set aside for working capital appears next and the study to determine working capital would be discussed in the report. It has been the writer's experience that this is probably the area where most optimism and subsequent trouble occurs. Determination of working capital requirements basically includes ascertaining minimum bank balances that must be maintained in order to do business, and this will no doubt involve certain compensating balances in connection with loans that are to be made. The amount of working capital that will be tied up in accounts receivable from customers must be carefully studied, and the requirements for inventory must likewise be considered. A certain amount of working capital is, of course, provided in the form of open accounts payable to vendors, and in the accrual for Federal income taxes and other current liabilities which in effect provide working capital. This is an area that has been subject to a great amount of error and therefore deserves the closest scrutiny.

The next item is funds applied for the payment of bank loans, and in the example shown bank loans will be paid out during the first year of operations. Long term debt, whether it be debentures, bonds or whatever form it may take, would be payable during the three years following payment of the bank loans.

(*Continued on page 52*)

CONVENTIONAL MINING In THIN SEAMS

By JAMES D. CARTER
Mine Superintendent
Osborne Mining Corp.

To overcome some of the problems of thin seam mining, Pond Creek Mine has increased the width and depth of cuts, installed large capacity elevators at loading points, changed car spotting arrangements and altered mine projections. Result—increased production and lower costs

THE first conventional mining unit with shuttle cars was placed in operation at Osborne Mining Corporation's Pond Creek Mine, located at South Williamson, Ky., in December 1956. Prior to that time 12-BU loading machines were loading either onto chain conveyors or directly into mine cars. In the modernization program this type of conventional mining was selected because the mine has several areas developed by hand loading, which are unsuitable for conveyor mining, and the property has a large reserve of coal varying from 40 to 53 in. in height. Continuous mining was not considered at that time because of the extremely hard impurities found in the seam.

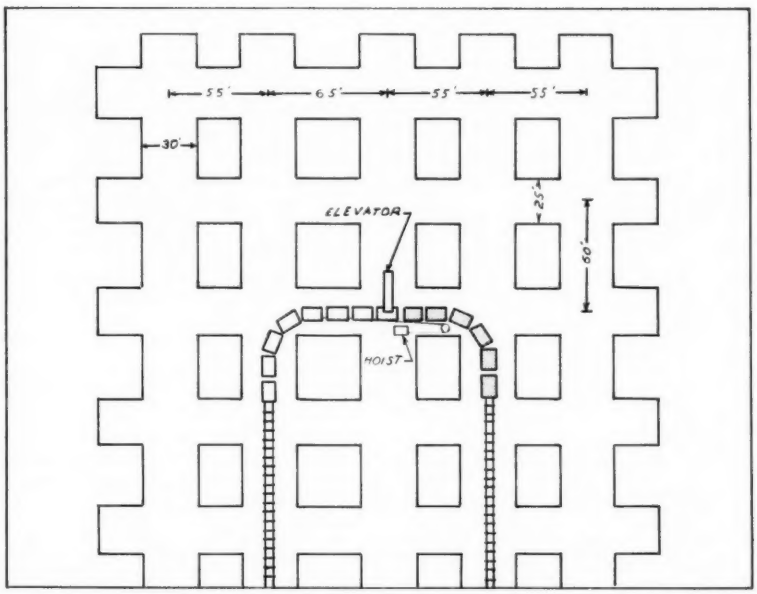
In the present working areas the seam varies from 32 to 36 in. in height, excluding sandstone intrusions from the roof and bottom. When such intrusions persist for considerable distances, the necessary entries are driven by rock crews. There is a parting of gray bone two in. thick located near the bottom and a band of laminated coal and bone six in. thick found about three in. from the roof. Sandstone is sometimes found replacing the bone streak near the bottom, varying in size from small flakes to pieces covering areas of several square feet. A modern preparation plant was constructed in 1957 to separate these impurities from the coal.

The immediate roof is made up of shale or sandstone. As a general rule when the shale is more than one ft thick, it can be controlled with post timbering. When less than one ft in thickness, it usually breaks and falls with the coal or is so weak that it has to be taken down. Three in. of shale can be loaded with the coal without considerable delay, but it is not economically possible to handle thicker material. Sandstone usually provides a firm roof near the face, but after being exposed for a period of several months in entries, massive falls occur. Only post timbering is used for roof support at the present time.

Bottom is fire clay covered with an extremely hard shale or sandy clay from two to six in. in thickness which provides a good roadway except in squeezed areas or in places where water accumulates.

Different Bits Tried in Effort to Reduce Cutting Cost

The coal is undercut and the bottom bone streak must be cut out for clearance; this, together with the hard bottom, which has to be followed closely, makes cutting conditions difficult. The mine has used several types of cutting machine bits in the past in an effort to reduce the cutting cost, and at the same time increase the tonnage prepared. When using plain throw-away bits approxi-



One section at the Pond Creek Mine has loaded as many as 357 cars in one shift with the spotting arrangement shown above. Hoist is placed with the control end near the boom operator who works across the track from the elevator

mately 250 had to be set per shift, and frequently bits would have to be replaced twice before a cut could be completed. By using the ½ by 1-in. type with tungsten carbide inserts, about 70 bits had to be set per shift, and a cut could be finished before having to replace them. Bit cost per ton while using this type was three times more than the plain bit cost, but the increased tonnage cut per shift more than offset this higher cost. At the present time management is experimenting with ½ by 1-in. bits with inserts in the extreme down lugs and the tipped throw-away type in all others. It appears as though this may be the best combination.

Extra Equipment Available in Case of Breakdowns

Sections are developed by driving five entries 30 ft wide on centers of 55 and 65 ft with breakthroughs every sixty ft. Rooms 40 ft wide and 250 ft long are driven to the left and right on the retreat, and the stumps are not recovered. The loop track system is used in section entries with 30-lb steel on the empty side and 40-lb steel on the load side. Top or bottom is not removed for clearance on section entries.

Section equipment consists of the following:

2—Loading machines
2—Cutting machines
2—Shuttle cars
1—Elevator
1—Car hoist

The extra loading and cutting machines are used only when the regular machinery breaks down.

A section crew consists of the following nine men:

1—Loader operator
1—Cutting machine operator
1—Cutting machine helper
1—Driller
2—Shuttle car operators
1—Boom operator
1—Repairman
1—Section foreman

The driller and cutting machine helper drill the face while it is being cut. The driller shoots the cut after the machine leaves. The repairman does the timbering and rockdusting in addition to the repair work.

The following are some of the more serious problems the company has encountered in thin seam conventional mining:

1. Low tonnage is realized per cut and area covered.
2. Movement of men and equipment is relatively slow.
3. Shuttle cars are difficult to load.
4. Shuttle cars and mine cars have low tonnage capacity.
5. Equipment receives more abuse in thin seams.
6. Maintenance costs are relatively high.

Low Tonnage Realized per Cut and Area Mined

It is easily understood that a cut of coal 34 in. high covering the same area as a cut in coal 68 in. in height will provide only half the tonnage. To produce the same tonnage per shift, twice as many cuts would have to be prepared and loaded in the thinner seam. Considering the face unit production of some mines in seams 68 in. thick, this would be a very difficult task. Assuming the same roof conditions and percentage of recovery, the labor cost per ton for track and wire, dust control, roof control, etc., is more in the thinner seam because twice as much area has to be mined to recover the same tonnage. A further increase in cost is realized because the low seam height limits the efficiency of the workmen.

At the Pond Creek Mine management has attempted to overcome some of these disadvantages by increasing the depth of the cuts, with the use of longer cutter bars, and by driving wider section entries and rooms. At one time cutter bars 6½ ft long were used because of difficult cutting conditions, but during the last few years the bar length has been gradually increased to ten ft. At present the mine is experimenting with a bar 15 ft long mounted on a universal-type cutting machine. In using the 15-ft bar the depth of the cut is approximately 13½ ft. The bar is sumped in about six ft on the right side of the face, and the entire width is cut at this depth. The machine is then pulled back, and by swinging the cutter bar the dust is cleared for the second sumping operation. After the second sumping the remaining 7½ ft of depth is cut. The peak power load of the cutting machine has not been increased, and there is very little difference in the place change time. The mine does not have enough experience with the bar at this time to determine all of its advantages and disadvantages, but believes the longer unit may be helpful in increasing production.

The company has found that deep cuts are difficult to shoot by using the common method of placing the explosive charge near the rear of the cut. The rear is usually broken well, but the front falls in pieces too large for the loading machine to handle. For this reason long holes are drilled eight ft apart and short holes are placed between them. All holes are drilled parallel and as close to the roof as possible. This is necessary because the coal adheres to the roof and may have to be taken down by hand. A low velocity explosive is used so that a larger area of the cut can be broken. The explosive cost per ton has remained the same regardless of the cut depth.

The advantage realized by increasing the depth and width of a cut

should not be underestimated. When preparing a face 20 ft wide with a cutter bar nine ft long, approximately 18 tons will be realized. Compare this to a face 40 ft wide cut with a bar 15 ft long that will provide approximately 63 tons. The larger cut greatly reduces the time lost in equipment place changes and many other time losses in the working cycle too numerous to mention. All conditions being equal, production can be improved from 30 to 40 percent by increasing the width and depth of cuts. Better supervision is also realized because there are fewer places worked and less equipment moves per shift.

Shuttle Cars Are Difficult to Load

Coal at the Pond Creek Mine is very firm and the impurity band tends to bind it together in large pieces. Considering the shuttle car bumper height to be 14 in. and the loading machine conveying pan to be six in. from the bottom of the boom, 20 in. of clearance is lost under perfect conditions. In coal 34 in. high, only 14 in. of height is left to convey material into the shuttle car. Therefore, it is necessary for the loading machine conveyor chain to crush any pieces larger than 14 in., and smaller pieces when the conveyor is heavily loaded. To date the company has made little progress in solving this problem. Several different loading machine conveyor chains have been used, but none have been satisfactory on the mine's higher capacity loading machines. It is understood that some equipment manufacturers are making shuttle cars with an adjustable rear bumper which can be controlled by the operators for loading and tramming. This, together with a lower coal line on the loading machine would be a great improvement for loading in thin seams.

Wider working places facilitate easier loading because the shuttle car can be aligned with the loading machine boom. Unfavorable natural conditions, such as irregularities in top and bottom, are not as bothersome to shuttle car haulage in the wider rooms and entries because shuttle car operators may select a better path to clear such irregularities.

Effective Capacity of Shuttle Cars and Mine Cars Increased

Under Pond Creek's present mining conditions, the average capacity of shuttle cars and mine cars is two tons. Before installation of elevators at loading stations, the capacity was 1.8 tons because the shuttle cars were loaded light to make certain all of the coal could be contained in one mine car. The shuttle car delay in waiting for another mine car to be pulled into position under the ramp more than offset the advantage of hauling a larger load.

To increase the effective capacity of mine cars and shuttle cars, an elevator with a storage capacity of approximately four tons was constructed. The shuttle car can haul a maximum load and store it in the elevator. Maximum load on mine cars is important at this mine because they provide raw coal storage for coal produced on the second and third shifts. There are no raw coal storage facilities on the surface.

The present car hoist and rope arrangement is the most efficient management has found for its over-all conditions. The hoist is placed with the control end near the boom operator who works across the track from the elevator. The rope comes off the drum and passes through a sheave secured to a pipe jack on the bottom. After leaving the sheave, the rope returns parallel with the loads and empties to the boom operator who places it on cars to be pulled. When driving section entries and loading on a loop, from three to four cars can be spotted before the rope is changed; and when loading on straight track from five to seven cars can be spotted before changes. By having a longer distance between entries No. 2 and No. 3, more straight track is provided so that a greater number of cars can be pulled without wrecking. This spotting arrangement may appear as though it would be very inefficient, but one section has loaded as many as 357 cars in one shift.

Equipment Receives More Abuse in Thin Seams

Thin seams provide very little clearance between the equipment and the roof, and when the coal becomes extremely low or top and bottom conditions are uneven, the equipment comes into contact with the roof. This is particularly destructive to shuttle cars because the protective cover plates are ripped off or crushed down so as to impair the operation of units beneath them. The increased pressure caused by roof contact causes bent or broken frames, wheel unit breakdowns and extra tire failures. If shuttle cars operate for prolonged periods in contact with the roof, traction motor failures are more common. Large pieces of coal or impurities accumulate on cover plates which causes a retarding and crushing effect on the equipment. The maximum clearance possible is maintained by removing any coal left adhering to the top or bottom. Solid rubber tires have lessened tire failures, and have also enabled management to lower the over-all height of shuttle cars while still having ample tire load capacity. Cover plates have also been made stronger and better supported.

Thin seams do not provide good visibility for equipment operators and, consequently, collisions with obstructions and other equipment are more likely than in higher seams. When the shuttle car is approaching the loading machine it is very difficult for the shuttle car operator to see the boom. If proper alignment is not made, the shuttle car rams the loading boom causing damage, occasionally, to both the car and loader.

Maintenance Is More Difficult

Thin seam equipment is usually very compact and has relatively poor accessibility for maintenance. To further hamper maintenance, there is very little clearance on top or beneath the equipment. This problem has been attacked by blasting a hole in the roof 10 ft wide, 15 ft long and 2 ft high every time the section is moved up. Therefore, if a piece of machinery can be trammed or pulled to the hole, it can be repaired much faster when additional head room is needed.

In summary, it appears that increasing the tons per cut or per working place is the most important single factor contributing to better efficiency in conventional mining in thin seams. If natural conditions permit, the most apparent method is preparing and loading wider and deeper cuts. There are other methods of increasing the tonnage prepared per working place such as planning rooms and breakthroughs in a way as to provide three places to cut each time the cutting machine visits a place.

The use of shuttle cars in thin seams has been limited in the past because of their low capacity and high maintenance cost. Manufacturers are making progress in lowering the height, and increasing hauling capacity by making wider and longer cars. Loading machines are also being made wider with lower coal lines to improve loading capacity and maintenance cost. These improvements may make shuttle car haulage more desirable in the future.

Outlook for U.S. Coal in Europe

By OMER ANDERSON

A German correspondent presents a keen analysis of major developments in Europe's year of coal crisis and takes an optimistic look at future prospects for importation of American coal

WESTERN Europe's coal glut is well into the second year, and obviously an economic malaise for which there is no panacea.

Such, in fact, has been the most significant development of the last year with respect to Europe's coal crisis—the forced acknowledgment that the coal crisis is worldwide.

At the outset, the Continent tried viewing the coal glut in terms of a scapegoat—the importation of American coal. Germans took the lead in trying to make American coal the villain in the Ruhr's glutted coal piles.

But the "Halden"—the glutted coal piles—stood at 7,000,000 tons when the tax of $4.74 a ton was imposed on imported American coal. Since imposition of the tax, the coal glut in Germany has grown to 18,000,000 tons, and American coal obviously is not the villain in the glut.

Ruhr to "Rationalize" Coal Industry

There have been these major developments in Europe's year of coal crisis:

1. The belated recognition that West Europe's coal industry must be made competitive—competitive within the industry on a nation-to-nation, and mine-to-mine basis; competitive with American coal, and competitive with petroleum.

2. Ruhr coal's failure to forge a

Two big problems of the German coal mining industry are : (1) the difficulty in getting apprentice miners, and (2) the difficulty in mechanizing operations in the Ruhr, where shafts are narrow and twisting. Young Germans are shunning mines—for reasons graphically depicted in picture

Coal "Halden"—glutted coal piles—at a German mine. The critical development now occurring in the Ruhr is its effort to "rationalize" the coal industry; to close marginal mines and to shift surplus miners to jobs outside the mining industry

united domestic front behind its demand for the virtual elimination of U. S. coal imports; the revolt of the port of Hamburg and certain major consumers, notably the electricity companies.

3. Tension produced by the coal glut within the European Coal and Steel Community (ECSC).

West Germany remains the key coal country in Western Europe, and the situation in the Ruhr is typical of that in the ECSC as a whole.

The critical development now occurring in the Ruhr is the effort to "rationalize" its coal industry; to close marginal mines and to shift the surplus miners to jobs outside the mining industry.

For the Ruhr, this represents a tremendous revolution. The long-range result promises to be a greatly enhanced competitive position for the German coal industry, based on considerably reduced but more efficient production.

The outlook seems generally favorable for American coal. The shift in emphasis from protecting the Ruhr industry to promoting its competitiveness means that American coal, to the extent that it can undersell Ruhr coal on the German market, will be accepted as a permanent feature of the German economic scene.

As concerns American coal, the outlook, long-range, is not for a vast market—but for a steady market based on sound economic factors. Most German coal experts agree that there should be a permanent future market in West Germany alone of 10,000,000 tons annually.

Germans have had to recognize that the big market in West Germany for American coal exists because U. S. coal is produced more efficiently.

Attempts to Prop Coal Have Failed

Since the outset of the coal glut, Economics Minister Ludwig Erhard has vainly tried one palliative after another in an effort to artificially improve the competitive position of Ruhr coal. Erhard now is near the end of the line. In the latest of a series of attempts to set prices and stimulate Ruhr coal consumption, he has announced a stiff tax on fuel oil: $7.14 per metric ton (about $1 per bbl).

The tax will replace another government attempt to reduce oil use by setting up an oil cartel. Under the cartel, major oil companies last December were pressured by Bonn to fix prices at $22 per metric ton (about $3 per bbl), and not to advertise. But cheaper oil flooded in from neighboring nations and Iron Curtain countries. Small, noncartel companies cut oil prices as low as $15 a ton and tripled their share of the market, to 25 percent. Finally, Esso A.G., a subsidiary of Standard Oil of New Jersey, alarmed because its share of the market had shriveled from 35 percent to 25 percent, pulled out of the cartel, to be followed by Shell, Mobiloil and British Petroleum.

Other attempts to prop coal also have failed, notably the $4.76-per-ton-tariff on all coal imports exceeding 5,000,000 tons a year, mostly from the United States. This was in the period when the Germans attempted to deal with the coal glut solely in terms of finding a scapegoat—U. S. coal.

But the effort to tax American coal out of the German market accomplished nothing in this direction. The tariff halved imports from the United States to 3,100,000 tons in the first six months of 1959—but German surpluses went up by almost 5,000,000 tons in the same period.

Now the Germans are gradually coming around to accept that the obvious solution would be to unshackle the fuel market. The difficulty is that such a facing up to economic facts inevitably will mean reducing the output of the uneconomic coal industry, rather than curtailing Germany's fast-growing, efficient oil industry.

Miners Average Two TPD

West German miners dig only two tons a day, and Ruhr coal still sells in German port cities for $4.75 a ton more than U. S. coal, despite the tariff.

West German coal production of 132,000,000 tons a year far exceeds demand, and Ruhr coal exports have collapsed because of surpluses in France of 11,100,000 tons, and in Belgium of 7,900,000 tons. But—until lately—Chancellor Konrad Adenauer's government felt committed to preserve the jobs of West Germany's 306,000 coal miners, fearing the power at the polls of the 600,000-member union of coal, iron ore and potash miners.

Patently, this was economic nonsense in terms of the West German labor market, which lists under 200,000 jobless as against 350,000 unfilled jobs. The Germans have the tightest labor shortage in the Western world, a situation made to order for the rationalization of the coal mining industry now being started.

All told, the German coal mining industry employs 450,000 people or six percent of the nation's labor force.

Coal Crisis Dates Back to 1958

The coal crisis in Germany dates back to early 1958. Pit-head stocks of coal were but 753,000 tons at the end of 1957, or about seven percent of a month's production. But from that time on, stocks began increasing, and by mid-1958 had multiplied tenfold, reaching 7,400,000 tons. By the end of 1958, stocks were up to 13,100,000 tons. In February 1958 the

first shifts were dropped by collieries in an effort to reduce production. From that month on the German miner has been in trouble.

According to the miners' union, the glut has cost the miners 40,000,000 man-hours of work since February 22, 1958, through July 1959, and a loss of pay amounting to $30,000,000.

In addition to punitive taxation on U. S. coal and domestic oil, the Bonn government and mining industry have resorted to a series of other expedients, all of which failed.

Coal price rebates were offered for bulk purchases by industrial consumers; the German coal industry offered to finance the canceling of contracts between German importers and American coal exporters; the holders of domestic licenses for the importation of U. S. coal were asked to abstain from using the license, the domestic coal industry compensating the cooperating German consumer.

The industry also negotiated a new collective bargaining agreement with the miners' union, providing for a cut in the miners' regular work week from about 43 to 40 hours with almost full pay from May 1, 1959, on.

The Germans decided upon their drastic "rationalization" surgery only after exhausting virtually every remotely possible device for artificially sustaining the Ruhr coal industry in its traditional format. Step by step, the Adenauer government demonstrated to the industry and to the miners that there was no other recourse but surgery. This point is illustrated by the campaign to reduce U. S. coal importation.

Coal Importation Reduced, Yet Stockpiles Grow

Foreign coal imports in 1957 amounted to 21,600,000 tons, of of which 16,000,000 came from the United States and the balance from Britain. In 1958 foreign coal importation was reduced to 16,200,000 tons, of which 11,300,000 tons came from the United States. Also, the German coal industry reduced its labor force by about 51,000 (from 495,996 to 444,700) between the end of January 1958 and August 6, 1959, principally by attrition.

Despite these measures, the "Halden" did not diminish; on the contrary, they continued to grow, although at a reduced rate. In 1958, stocks had increased by an average 1,030,000 tons a month. From January through April 1959, the monthly increase averaged 681,000 tons. Stocks mounted to an aggregate 17,000,000 tons—or almost two months production—in early August 1959.

And production, while the glut grew, held astonishingly steady, despite all efforts to cut back output. Production amounted to 133,200,000 tons in 1957; to 132,600,000 tons in 1958; and to 73,330,000 tons in the first seven months of 1959—down only 6.3 percent from the same period in 1958. While production per manshift was 1585 kg in 1957 and 1642 kg in 1958, it rose to 1891 kg in July 1959. Part of this increase was due to heavy modernization investment by the collieries, and part to miner uneasiness concerning job security.

Steel plants are going up along the coast all over Europe and their future is wedded to imported ore—and coal

Unions Demand Nationalization of Coal Industry

The mine nationalization program now being undertaken has been preceded by bitter three-way debate among the miners, the coal producers and the government. The unions demanded nationalization of the coal industry, but the owners successfully defended themselves by pointing out that the coal glut exists throughout Western Europe; in fact, it is worldwide—that it is no worse, relatively, in West Germany than in Belgium, Britain, the United States or Canada.

The government contended that any customs duty or tax on coal could only be a temporary measure; that the coal industry must become competitive with foreign coal and with petroleum, however painful this might be.

Finally, the producers won their point that the government bears primary responsibility for extricating the coal industry from the glutted production impasse. Until the glut, the government had belabored producers and the unions to increase production as a patriotic duty to the national economy. The government exerted colossal and unremitting effort to spur coal production.

Remedial Steps Include Stiff Fuel Oil Tax

So much for the background to the glut. Now, producers, miners and the government are agreed that the facts have to be faced. These are the steps to be taken under the program to "rationalize" production:

1. The stiff tax on fuel oil—$7.14 per metric ton or $1 per barrel.

2. The government is considering signing an agreement with the High Authority of the European Coal and Steel Community (ECSC) for the sharing of expenses connected with finding jobs outside the coal industry for surplus miners.

3. The coal industry will close up to 17 marginal mines, reduce the miner force by up to 50,000 through attrition, and undertake maximum feasible mine modernization.

Dr. Ludger Westrick, deputy to Economics Minister Ludwig Erhard, explained:

"By imposition of the fuel oil tax we do not intend to try shielding the German coal industry from any and all competition. Frankly, we have no enthusiasm for this

tax; but something had to be done, and nobody had any better proposal.

"The Government feels that the coal industry, the nation's main source of energy, should be protected from a ruinous price war, and that it should be assisted to find a proper place within the nation's energy supply scheme.

"As regards fuel oil, the government has no desire to halt the increasing consumption; it merely seeks to retard somewhat the advance of oil until the coal industry can overcome its difficulties."

The Institute of German Industry commented:

"Coal still is, and will continue to be, the nation's main supplier of energy, accounting for about 70 percent of energy consumption in West Germany as against 13 percent for fuel oil.

"The coal industry knows it will have to face competition—from oil, now; perhaps later from atomic energy. But it feels entitled to a fair period of adjustment, a period in which to complete modernization, which is in full swing."

Coastal Areas Oppose Effort to Curb Coal Imports

The Adenauer government is being subjected to great pressure and counter-pressure on the coal issue. Miners have staged a series of protest demonstrations, including a "march" on Bonn by 54,000 miners.

Communists have tried to turn the demonstrations into rallies "for understanding with the East" and "against atomic arms in West Germany." The Communists take the line that if the government weren't spending so heavily on rearmament, it would have more money to aid the miners.

But the government is also being subjected to strong counter-pressure on behalf of U. S. coal. The port of Hamburg, in particular, has come to have a tremendous stake in the American coal trade.

A City of Hamburg statement said:

"West Germany's coastal areas are strongly opposed to the effort at curbing coal imports by prohibitive customs duties, and the ban on negotiating new import contracts.

"These areas of north Germany have relied largely—for decades—on coal imporetd from the United States, Britain and Poland. It is far cheaper for north Germany to import coal from abroad than to transport Ruhr coal by rail to north Germany—strange as this may seem.

"For example, nearly 70 percent of Hamburg's total coal consumption is normally covered by imports from these three countries, the United States, Britain and Poland.

"The artificial restriction of these imports will raise prices for the housewife and increase production costs in a wide section of industry. Cargo turnover in our ports will be drastically reduced, with a considerable loss in handling fees, and shipyards must expect the cancellation of orders for new coal carriers.

"Furthermore, shipowners with now-obsolete long-term coal import contracts will have to look for other, less profitable cargo, and they very likely will be forced to lay up some of their ships.

"And, perhaps most alarming, such calculated efforts to discriminate against American coal importation are damaging to our relations with the United States, particularly our trade relations. We must expect retaliatory measures."

Americans Express Views

There is, in this direction, considerable nervousness in the Adenauer government over the growing tendency in the United States to take a new, hard look at American economic assistance to foreign nations.

It is recognized by the Adenauer government that opposition is growing to the continued expenditure of vast sums to maintain American troops and airmen in West Germany.

The United States not only contributed some two billion dollars worth of military equipment to the West German Armed Forces—the Bundeswehr—but has been footing almost the entire cost of keeping the U. S. garrison in Germany, items of electricity, telephones, utilities, rents and rail transportation as well as obvious costs for pay, food, and equipment.

For example, Senator Vance Hartke, the Indiana Democrat, was applauded by American embassy officials for his plain talking to the Germans on the subject of coal. The senator, in the course of a visit to the German capital, lectured Chancellor Adenauer:

"European nations should tread lightly with any steps that threaten the American economy. An economically powerful United States is an absolute necessity in the Cold War struggle against the Russians.

"There is no doubt that the Bonn government made a serious mistake in imposing a discriminatory import tax on American coal. The American coal industry is in trouble, and unemployment in the U. S. coal fields is damaging the American economy.

"We understand the German problems, of course, but we feel the Germans could take steps to improve their coal situation without causing further damage to our industry.

"American aid has done a lot to promote West Germany's economic health. It seems a strange sort of return for the Germans to injure America's economic health."

American officials on the spot feel that the Germans have dallied about tidying up Ruhr coal production; that instead of pressing more efficient production they have concentrated almost exclusively on making American coal the scapegoat for the inefficient domestic industry.

Be this as it may, it is nonetheless true that the coal crisis is general throughout the ECSC. So serious is the crisis within the ECSC that it could wreck the coal and steel pool. Total coal stocks within the ECSC now stand at around 34,000,000 tons, and the coal glut is straining the fabric of the coal and steel pool.

French Block Efforts to Have ECSC Deal with Coal Glut

In the early years of coal shortages, the ECSC worked very well. France, the nation which had taken the leadership in endowing the ECSC with wide powers, was well satisfied at the way it provided France with German coal on advantageous terms.

But now the French view of ECSC has changed. The French coal industry is relatively well off, and the French have blocked all efforts to have the ECSC deal with the glut on a pool-wide basis. This could be done under the pool charter's provision for a "declaration of manifest crisis," which would permit the fixing of production and import quotas.

Not only do the French now have all the coal they need, but they have just come into possession of oil riches from the Sahara.

Now the French view the ECSC as machinery for getting favored treatment of France's prospective huge stocks of natural gas and oil.

One of 17 marginal mines in West Germany scheduled to be closed. It is now recognized that West Europe's coal industry needs to be made competitive—competitive on a nation-to-nation and mine-to-mine basis; competitive with American coal, and competitive with petroleum

By 1965 France expects to have 50,000,000 tons of Sahara oil to market, more than double its own present domestic requirement. By the same date, the Sahara gas fields will be yielding nine billion cubic meters of natural gas annually—the thermal equivalent of 12,000,000 tons of coal.

The Lacq oil fields in southern France can provide another 5,000,000 tons of coal equivalent each year. France wants to market these fuels in Europe partly as a simple business proposition, and partly to protect its own coal mines.

The coal industries of the other ECSC countries can be expected to resist the advent of the French oil and gas, but these fuels will have great appeal to industry generally within the ECSC.

Therefore, it is now very much in the French interest to water down the power of the ECSC High Authority, and this in fact is what Couve de Murville, the French foreign minister, is preparing to do. The French would like, if possible, to go even further—to merge the genuinely supranational ECSC with the European Common Market, which is less a supranational agency than a concert of national governments.

The outlook for American coal, as concerns the ECSC, is for a steady erosion of the pool's supranational character, culminating into its merger with the Common Market. This means that U. S. coal can expect to do business in the future with the six national governments on an individual and independent basis; that the ECSC can be considered a moribund institution barring a sharp reversal of the current trend.

Such, then, is the European coal picture—a picture of unrelieved and ever growing glut, but a picture slowly taking on overtones of economic sense. But the present trend, if continued, should favor the long-range importation of American coal on a modest, economic sense-making basis, particularly in Germany.

Labor Study Confirms Favorable Prospects for Coal

In Geneva, the International Labor Organization has just issued the results of a study confirming long-term favorable prospects for the coal industry generally.

ILO's study, prepared for its Coal Mines Committee, noted that the coal crisis is widespread. "The competition of other forms of energy, mainly of fuel oil, the recession in Western Europe and North America, and generally mild winters are largely responsible for an over-supply of coal after many years of shortage," the ILO report states.

The report finds that "price will play a growing role in the competition between coal and other forms of energy. The elimination of high-cost mines will present a social problem of varying importance in many countries," continues the ILO report, "and may spell the virtual end of coal mining in a few."

However, the report then makes this crucial point:

> "The growth of the world demand for energy can confidently be expected to continue to rise at a fast rate.
>
> "Thus, while coal will gradually recede in its proportional importance as a source of energy, it is not likely to experience a loss in absolute demand within the foreseeable future."

Throughout the world, the report continues, "there has been a continuous shift in consumption toward oil. This is the product of changes in demand caused by such factors as the natural superiority of oil in certain fields, price competition, and temporary coal shortages."

The report emphasizes that "the coal industry is particularly sensitive to market fluctuations. A small drop in demand which would go virtually unnoticed in many manufacturing industries raises grave problems in coal mining.

"Pithead stocks accumulate rapidly. A reduction in output can only be achieved by either reducing working time or by dismissals."

Finally, the report notes the trend toward the acceptance of periodic glut as a normal feature of the coal industry, and the development of stockpiling policies to cope with glut.

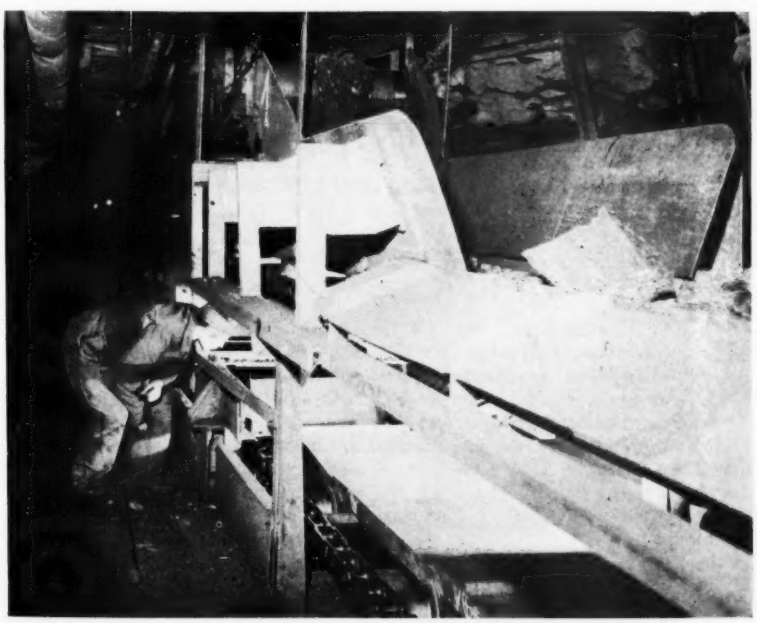
Just now Europe's coal glut is appearing less grim in the light of a general upsurge in steel production. In all European steel-producing countries the output is climbing. West Germany, for example, is now producing at the rate of 27,000,000 tons annually, and will establish a 1959 all-time German production record of over 25,000,000 tons.

Key Factor Is Cost

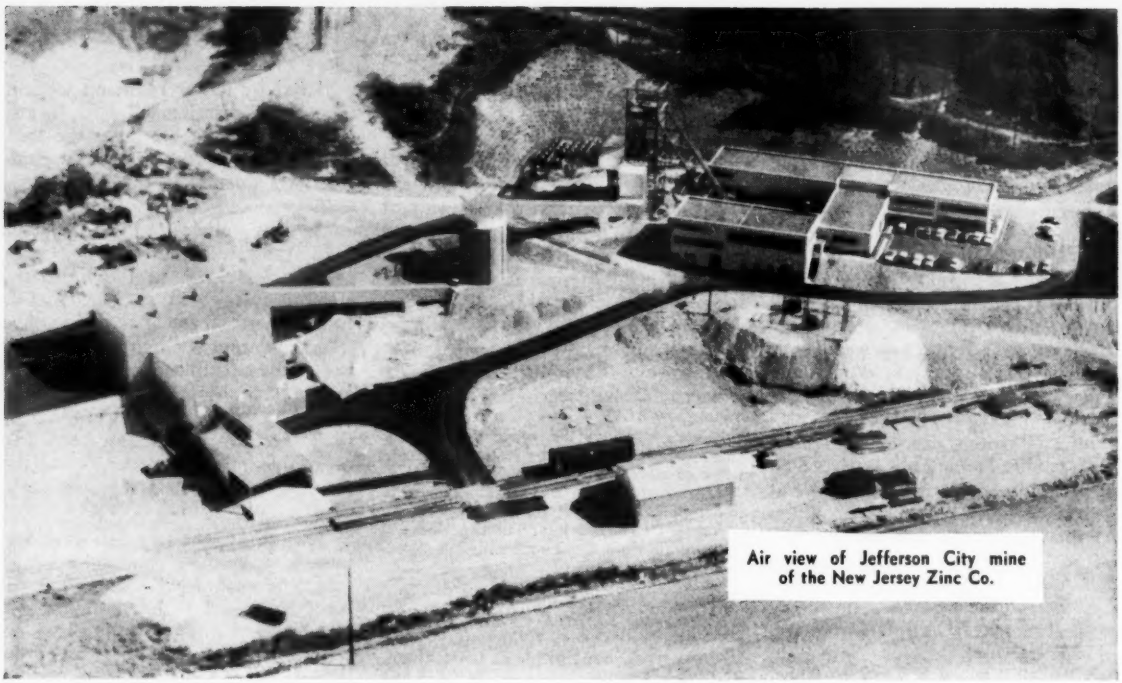
To sum up, the key fact developed by all prognoses concerning coal's future is cost. Coal's battle for survival is hinged to low-unit-cost production, and this fact is the best reason why American coal can be counted on to retain its basic gains in the European market.

Moreover, the U. S. steel strike has increased the prospects for a partial restoration of the Korean War situation when German steel producers imported U. S. coal to produce steel for the American market.

Steel plants are going up all over Europe at the water's edge, the latest such project being a plant at Dunkirk, in France. The future of these plants is wedded to imported ore—and coal.



Zollverein mine, one of West Germany's most highly mechanized operations, is regarded as a model for the German coal industry



Air view of Jefferson City mine of the New Jersey Zinc Co.

MINE MECHANIZATION in Eastern Tennessee Zinc Mines

By JOHNSON CRAWFORD
Assistant Manager of Mines
The New Jersey Zinc Co.

As the zinc mining industry has been compelled to face up to increasingly adverse economic circumstances, the emphasis has been on more intensive mechanization for increased efficiency

SINCE the end of World War II, extensive zinc explorations in East Tennessee have added substantially to the known zinc reserves, and have established East Tennessee as one of the major zinc producing areas of the nation.

Zinc mining operations in East Tennessee are conducted by the New Jersey Zinc Co., the American Zinc Co. and the Tennessee Coal & Iron Division of United States Steel Corp. Nine mines are currently in operation, and the presently installed mill capacity of the three operating companies is 10,500 tpd of crude ore. Of this total, 8500 tons is in the Jefferson City-Mascot district and 2000 tons in the Copper Ridge district. The average monthly production of zinc concentrates from these two areas approximates 13,000 tons.

New Jersey Zinc, which is the largest producer in East Tennessee, operates the Jefferson City mine in the Jefferson City-Mascot district, and the Flat Gap mine at Treadway in the Copper Ridge district. Each of these properties is equipped with a mill of 2000 tons daily capacity. They are newly developed mines and are highly mechanized. The Jefferson City mine started production in October, 1956, and the Flat Gap mine made its initial production in January, 1959.

Trend of Mechanization

Mine mechanization in the East Tennessee zinc district has been a gradually evolving process. It began with the advent of the slusher hoist and track mounted air shovels for ore loading. Various types of shovels mounted on caterpillar tracks have been used including the Drott skid shovel, Eimco models 104, 105 and 630. Slushers mounted on portable ramps loading into a shuttle car were used in one mine. Finally, the Gismo powered by tractors with caterpillar treads on both the loader and power unit was introduced in three of the mines. Then came the rubber tired

front end loaders.

The trend of mechanization has been from mine rail to caterpillar tracks to rubber tired mounting, each with a resulting improvement in efficiencies and production costs. Present thinking is that rubber tired mounted loaders have greater efficiency and lower maintenance costs. Most operators find that equipment mounted on steel caterpillar treads is expensive to maintain because of the absence of any cushioning from operating on the hard rock of mine floors. Now the Gismo has been put on rubber tires and with some other modifications is known as the Transloader. Small shovels, such as the Koehring scooper, loading into trucks are being used with high hopes and expectations.

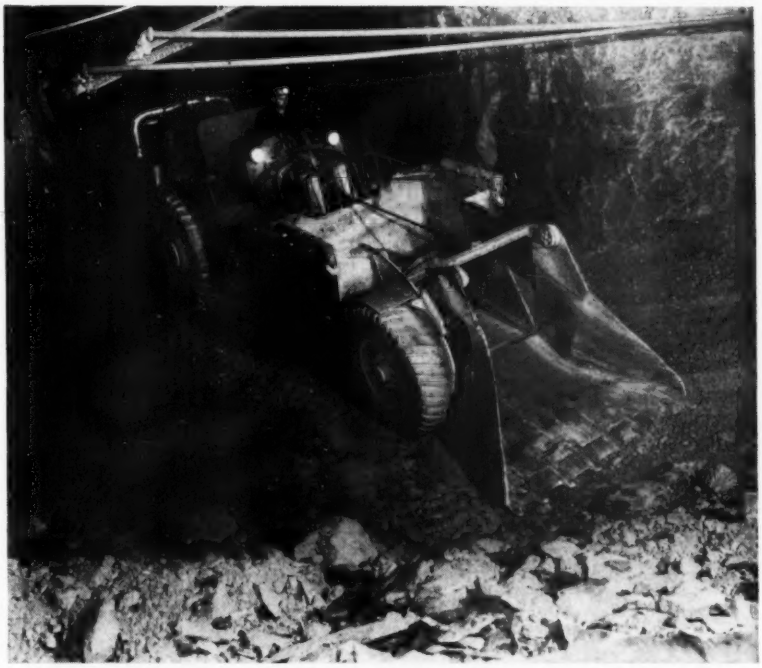
Equipment used for ore breaking has substantially changed in recent years. The column mounted drill was replaced by jack leg drills. Then came drills mounted on portable equipment such as the drill mobile. Various types of track and tractor mounted drill jumbos have been used including two, three, four and even five drill mountings.

As the zinc mining industry has been compelled to face up to increasingly adverse economic circumstances resulting from excessive foreign imports and rising labor costs, the emphasis has been on more intensive mechanization. The older mines are at a distinct disadvantage. In some cases, shafts and haulageways are too small to permit use of modern mechanized equipment. In other cases, known ore reserves are not considered sufficient to justify the expenditure necessary to mechanize. In the development of the newer mines, however, the basic plan is one of mechanization. Openings of sufficient size to permit the installation of large heavy equipment have been provided by large shafts or surface inclines. The Jefferson City mine is a good example of a recently developed property that has been designed to take full advantage of mechanization, and has had a gratifying measure of success.

Four Ore Horizons

Some description of the geometry of the Jefferson City ore occurrence is desirable in order to establish an appreciation of the circumstances under which mechanized equipment must operate and the need for flexibility.

At the Jefferson City mine, the formation dip averages 7°. The ore deposit has a strong stratigraphic control, and ore occurs irregularly at four horizons. While ore occurrence is extensive, it is erratic in detail and ore conditions vary substantially over relatively short distances—thicknesses vary from a minimum stoping height of nine ft to a maximum of approximately 100 ft.



A bottom discharging Transloader in the loading position. This unit has a five-ton capacity hopper and is used for trams up to 800 ft or more

The main hoisting shaft is rectangular with over-all dimensions of 19 by 13 ft. It has seven compartments and was sunk vertically to a depth of 1302 ft. An 8 by 12-ft cage compartment permits the entry of large equipment. The primary crusher is located below the sixth mining level station, and ore is fed to the crusher through finger gates controlling flow from the ore pass. Ore is crushed to minus four in. automatically loaded into skips and automatically hoisted. New Jersey Zinc is under the impression that the automatic skip hoist at Jefferson City is the second installation of its type operating on a-c power. The first such installation is at the Flat Gap mine.

A substantial economy is effected as a result of the design of the hoisting shaft. Only two men are required for coarse crushing and raising the ore from the ore pass to the surface; one at the finger gates and primary crusher, and one at the skip loading station where the skip hoist is controlled.

2000-TPD Surface Plant

The basic design of the plant and administration building adds much to the efficiency and economical administration of the mining operation. The building contains all service facilities including hoist room, shops, warehouse, bulk storage, change room, lamp room, electrical switchgear and offices.

For a period of more than one year, consideration was given to the planning, design and selection of facilities to be incorporated in this building. The result, we feel, has established a high for efficiency in administering and servicing an operation of this type.

The original mill was designed for a 1000 tpd operation, but primary and secondary crushing facilities for a 2000 tpd operation were provided. The mill is straight flotation and was designed so that its operation could be handled by three men per shift exclusive of secondary crushing operations. In April 1958, construction of a 1000 ton addition to the mill was started. On January 1, 1959, the capacity of the operation was increased to approximately 2000 tpd with no increase in the number of mill personnel exclusive of the secondary crushing operation. The mill is making a 98.5 percent recovery and concentrates average nearly 64 percent Zn.

Drill Jumbos Very Flexible

Ore breaking is accomplished using three drill, tractor mounted jumbos. Three Gardner-Denver model JTB booms are mounted on a D-4 Cater-

With the remotely controlled three drill tractor-mounted jumbo, a 30 ft wide by 18 ft high 74-hole round can be drilled out from one set up

pillar tractor. The tractor frame has been reinforced to withstand the load, and is equipped with an appropriate counterweight. Various types of starting equipment are in use including storage battery and hydraulic starters. The diesel engine is equipped with a wet type scrubber. Drilling is done by 3 in. drifters with automatic control backheads mounted on nine ft shells for nine ft drill travel inside the hole spotter. The drills are operated by remote controls on a panel conveniently located in front of the tractor seat. Each boom is equipped with drill positioners complete with 120° swing and 90° dump. Seven-eighths in. hex. drill steel with an integral carbide-insert wedge type bit is used. The drills operate at approximately 90 lb air pressure at the face. The rate of rock penetration approximates two fpm. Two men are employed in the operation of the three drill jumbo.

In many respects the drill jumbos are the most successful pieces of mechanized equipment in use on the property. The jumbos can negotiate slopes in excess of 40 percent, and permit substantial flexibility in mining. From one set up, the jumbo can drill out a round 30 ft wide and 18 ft high. A conventional burn-cut drill pattern is used for ore breaking. In a heading of this size, 74 nine in. holes are drilled for a total footage of 660 ft. Electric blasting is employed and about as much time is required to load and blast the round as is required to drill it. Commonly such a round can be drilled and blasted in an eight hr shift, and it will break around 450 tons of ore.

Because of the irregularities of the ore deposit many of the headings are of lesser dimension than that above mentioned. Careful selectivity in ore breaking is employed, and the ore limits are marked out with red paint by the mine foreman. The mine is operated on a two shift basis, and two blasters on each shift assist in preparing the rounds for blasting. The mining method is principally one of breast stoping with random pillars. In areas of thick ore, back stoping is employed.

STATISTICAL SUMMARY—May, 1959
Mining Department

General	
Men on payroll	96
Percent attendance	94.6
Shifts worked	1.952
Production	
Tons produced	38,323
Production shifts	811
Grade of ore	5.76%Zn
Development	
Feet advanced	290
Deadwork shifts	228
Test drilling — ft	1,816
Operating Efficiencies	
Tons produced per day	1,825
Tons per hourly shift worked	19.6
Tons per production shift	47
Summary Over-All Operation	
Mine department (hourly)	96
Plant department (hourly)	31
Salaried employees	28
Total number of employees	155
Tons per total shifts (Salary and Hourly)	12

Statistical summary for the month of May 1959 reports the results currently being obtained through mechanized mining at the Jefferson City mine. While these figures may be expected to vary, they are are representative of current production

The average production of a drill jumbo per shift approximates 150 tons. Operating on a two shift basis, an average of eleven jumbo shifts, or 5.5 jumbos, are required to produce approximately 1650 tons. To this tonnage is added the ore from development work.

The capacity of a jumbo to drill is presently in excess of our ability to utilize, and presents an interesting challenge. Some of the complicating features that prevent complete utilization of jumbo capacity are irregularities of the ore deposit, roof problems, failed rounds, and the logistics of stope locations. Also at times, and this is a happy one, the ore pass becomes full and the stopes become muck bound. Then again the jumbo capacity cannot be utilized.

Our studies indicate that three drills on a jumbo is the most efficient number for existing conditions. Two men can handle three drills, but if more drills are employed, man-power efficiency decreases.

The cost per ton of ore breaking including all labor, supplies, explosives and maintenance varies from $0.85 to 0.90 per crude ton.

Mechanizing Loading Operation

Probably the most difficult problem that confronted the company in mechanization of the mine, has been securing satisfactory types of loading equipment that could meet our special conditions. We learned through experience with various types of loaders at the Jefferson City mine and other mines, and from other operators and people in the business, what types of equipment were producing the best results.

Experience taught that a carefully planned and rigidly adhered to program of maintenance and service was vitally essential. It was found that certain types of men could operate the equipment more successfully than others. Observations revealed that there was a continuing improvement in loaders, and that the piece of equipment that looked best today is improved by a type that will come out tomorrow. Therefore, the company considers it prudent not to invest too heavily in any one type so as to be in position to take advantage of improved loaders as they are developed.

At the Jefferson City mine, several special conditions placed limitations on the type of loading equipment that could be used. Some of the ore at Jefferson City is only nine ft in thick-

(Continued on page 58)

Industry leaders expressed confidence in coal's future growth as they gathered to formulate the program for the 1960 AMC Coal Convention

1960 AMC COAL CONVENTION

Program Committee Meets in Pittsburgh

Primary objective of the Program Committee for the 1960 Coal Convention of the American Mining Congress, at its meeting in Pittsburgh November 4, was the selection of topics and speakers for next year's Coal Convention to be held in Pittsburgh, May 9–11.

Under the chairmanship of R. H. Hughes, President, Clinchfield Coal Company, the Committee drew up a program designed to point up the need for a national fuels policy and to highlight the latest advances in coal mining technology and safety—a program reflecting the confidence of all present in the future growth of the coal industry.

Representatives of various Government agencies dealing with coal together with important members of Congress will "kick off" the meeting with a discussion of the relationship between their activities and the coal industry. The remainder of the week will feature technical sessions devoted to bringing mining men abreast of the newest developments in continuous and conventional mining, strip mining, coal preparation, haulage, safety, power, and mine management. A general outline of the Convention program appears on this page.

It is further planned to have a Welcoming Luncheon, Monday, May 9 and a Special Luncheon honoring the AMC Coal Division on Tuesday, May 11.

Arrangements are also being made for a full schedule of entertainment for mining men and their ladies. Besides the Annual Coal Miners Party, which will be held Monday night, May 9, the customary banquet is planned for Wednesday evening, May 11, and, as always, will prove to be a fitting climax to the week's activities. Then too, there will be the customary round of individual parties and impromptu get-togethers.

To make sure that the women attending the Coal Convention are well taken care of, a special ladies committee is being appointed to plan a most enjoyable program. Because this is the first return of an AMC Coal Convention to Pittsburgh in over a quarter of a century, there will be many new things for them to see and do.

There is no getting away from it, all things point to a really big meeting, and it is not too early to start making plans.

Hotel accommodations will be assigned by a special Housing Bureau of the Pittsburgh Convention Bureau, and all applications should be sent directly to them at the Chamber of Commerce Bldg., 411–7th Street, Pittsburgh, Pa. In the near future, hotel reservations forms will be mailed to the industry, and their prompt return is urged.

This is one meting you cannot afford to miss!

PRELIMINARY PROGRAM

Monday morning—Opening session
National Fuels Policy

Tuesday morning
Safety
Coal Preparation

Wednesday morning
Underground Power
Management and Cost Controls

Monday afternoon
Thin Seam Mining
Strip Mining

Tuesday afternoon
Strip Mining
Underground Haulage

Wednesday afternoon
Coal Preparation
Thick Seam Mining

By
WALTER H. FLEMING*
Supervisor of Training
Coal Mines
Tennessee Coal & Iron Division
United States Steel Corporation

Training Programs for Operators of New Equipment

Cost of training programs to introduce new equipment "has been justified by attainment of full production in a short period of time with a minimum of safety problems"

A recent article in a newspaper revealed that an airline company bought a simulator for a jet airliner scheduled for service in 1960.

This simulator, which will be used in a program to train crews to operate the new equipment, will cost about one million dollars. This certainly emphasizes the value that airlines put on training.

The success or failure of any type new equipment, airliner or continuous mining machine, depends in a large measure upon proper instruction given supervisors, maintenance men and operators. The effectiveness of training can be measured by the performance of the new equipment.

Coal Mines and Ore Mines of Tennessee Coal & Iron Division, U. S. Steel Corp., for many years have utilized such programs to introduce new equipment. They are convinced that the cost of the programs has been justified by attainment of full production in a short period of time with a minimum of safety problems. It might be added that the cost of the programs is examined just as closely as any other cost to get full value for each dollar spent.

For the past several years the Ore Mines has been in a continuous program of adding new types of modern equipment. Some of the equipment was completely new to ore mining operations. Some equipment was, in one way or another, similar to that already being used.

Examples of completely new equipment include front end loaders, which are used to clean up roadways and to prepare muck piles for the loading machine. A remote-controlled roof bolting machine is another example. The operator's position is several feet from the face area. He operates levers that cause the machine to do everything from drilling the hole to tightening the nut. Proper and adequate training of these operators paid off quickly. They attained expected safety and production performance in a short period of time.

Teaching operators is just as necessary when the new equipment is similar to that already in use. The Ore Mines replaced some electrical-powered shuttle cars with diesel-powered cars. Training operators for these new cars received the same emphasis that would have been given had they been completely new. The Ore Mines reports that it would have been a gross mistake to have assumed that operators could make the change without new instruction just because of the similarity of the equipment. The super-size high capacity loading machines, and all other types of new equipment, are introduced to the operation with a program for developing the skill and knowledge of operators, maintenance men and supervisors.

Training Program—Five-Man Team Handles Instruction

Instruction of operators is handled by a five-man team consisting of a project engineer, two industrial engineers and two assistant mine foremen. These men attended an instructional guidance course to learn the techniques of teaching. When new equipment is received and before it is delivered to its place of operation, the team members become completely familiar with its make-up and how it is to be operated. Preparation is the key word for this team. They must be well prepared in order to get the desired results.

Team members, for the most part, give individual instruction. That is, a team member stays with and teaches the operator until he is satisfied that the operator can be put on his own, under normal supervision of a foreman. The team members meet in conference frequently to talk over mutual problems and to work out improved procedures.

The Coal Mines program for teaching men to operate new equipment is very similar to that of the Ore Mines. As in the Ore Mines, when new equipment is obtained, provision is always made to give planned instruction to those who will be connected with its operation. The Coal Mine's first real training endeavor of this type came several years ago with the advent of shuttle cars to the underground mining operation. Simulated underground roadways and clearances were laid out on the surface where operators were taught to drive the cars. They learned, in addition to actual operation, necessary maintenance checks, principles of operation, trailing cable care and safety precautions. After successful completion of the surface instruction the training was continued under-

** Prepared in collaboration with TCI's Ore Mines and Coal Mines.*

The three members of the coal mine training team review the progress they have made with each member of a low-coal continuous-mining-machine crew. In this review they set a definite time to revisit the crew to check results and reinstruct if necessary

ground. For the first few days underground, the trainees drove empty cars in an inactive section of the mine under the direction of an instructor. Next, the operators were assigned to an operating section where their training was continued by the foreman on the section.

A program for developing the skills of a man when he is assigned to operate a piece of equipment that is new to him is as important as the program used when new equipment is put into operation. When Concord Coal Mine was opened, for instance, a four-man team was used to convert successfully former hand-miners to mechanized mining and to teach men with no mining experience to operate the equipment.

The manner in which training is given varies with the circumstances. In some cases teams of instructors work together; in other cases single team members work individually with trainees. Many times, especially when the new equipment is very similar to old equipment, the foreman does the instructing.

All of these and other training programs for new equipment were developed from a basic five-part program. The five parts are:

1. **RESEARCH**
2. **PLANNING**
3. **PREPARATION**
4. **PRESENTATION**
5. **FOLLOW-UP**

A program used recently in the Coal Mines to develop operating crews and maintenance men to mine coal with auger-type low-coal continuous mining machines will be used to illustrate the basic program. This type equipment was new, not only to our Coal Mines, but to the coal industry as well.

Research—All Available Information Gathered

The first part of the program is research. All available information must be gathered. In this case, our engineers visited the manufacturing plant to learn how the machine was made. They observed the machine in operation in mines of other companies to get an idea of what type mining plans could be used.

A basic component of the continuous mining machine was compared with a shortwall mining machine that the company has used for years to determine what effect it would have on teaching the operators.

Another part of research was to learn from engineering and operating departments the operational procedures that would be used.

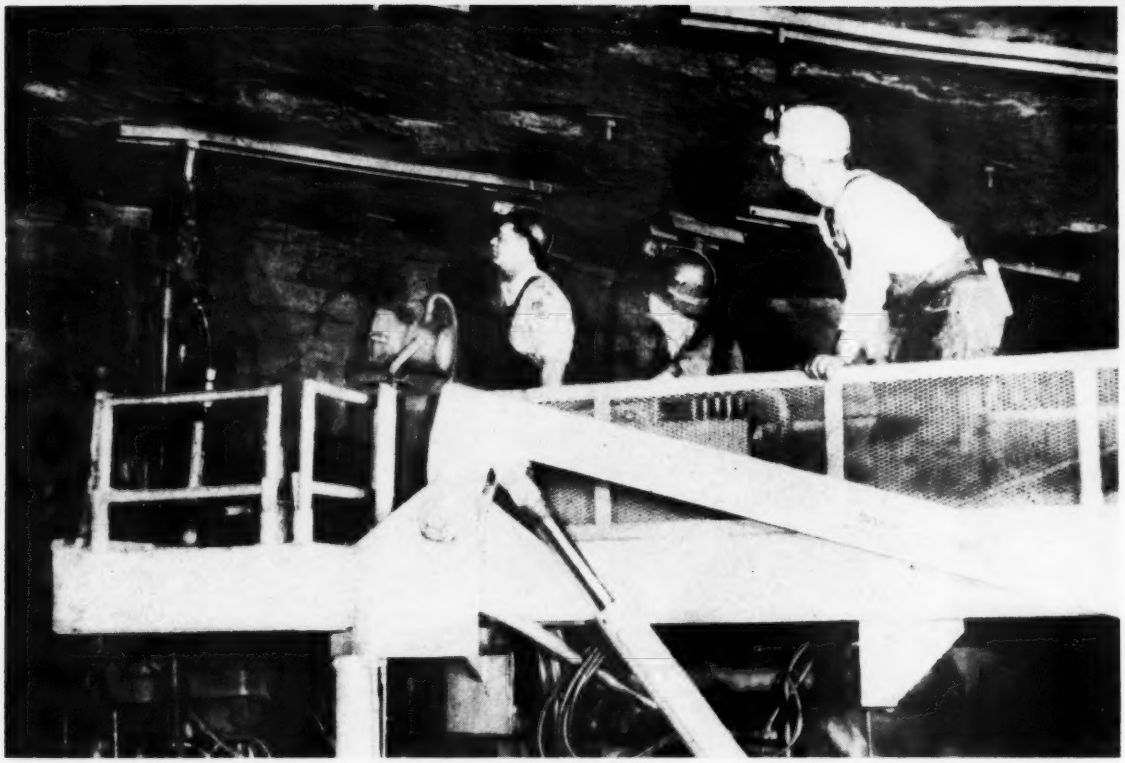
Gathering information and facts to develop a training program is as necessary as that needed to build the machine itself. If something is left out or not properly considered, it will show up sooner or later and slow up performance. The more real facts and information gathered in research the better and more complete will be the planning and execution of the actual training.

Planning—Many Decisions Must Be Made

Using the research information, planning the program comes next. In this stage of forming the program many decisions must be made. To train operators and maintenance men for the low-coal continuous mining machine, the decision was to use a team of three instructors (an operating foreman, a maintenance man and an industrial engineer). The selected team members did not have any prior experience with instructing in an undertaking of this sort. It was decided to give them a two weeks' course to prepare them. Instructors must be well qualified to give proper instruction. TCI has found truth in the old axiom "If the worker hasn't learned, the instructor hasn't taught." When the instructor knows how to teach, the worker will learn.

The time and effort devoted to improving the instructional skills of the training team members is well worthwhile. If they are not able to get the trainees to understand, learn and use the skills necessary to operate the new equipment, the program is doomed for failure from the very beginning.

Planning must be complete. Safety standards and requirements must be



Proper and adequate training paid off quickly when remote controlled roof bolt machines were placed in operation at the ore mines of TCI. The training team member, wearing the white hat, is shown teaching the crew to operate this machine

known, the operational procedure must be given to the planners, maintenance checks and lubrication procedures to be taught properly must be included in the planning of the program.

This, you see, calls for complete cooperation among many segments of the organization.

Preparation—Instructors Given Course

The third phase of the program is preparation. The instructors were given a two-week instructional course. It included sessions on the J.I.T. method of instructing, human relations, principles of operation of the equipment, how to make job breakdowns, maintenance procedures, and other related subjects. Their preparation also included observing a pilot machine in operation.

In the course of its preparation the team also prepared safety meeting outlines, job breakdowns, timber plans and maintenance check lists that would be needed to develop the crews. All phases of the preparation were checked and approved by the operating management. Training is a service that the operators are buying and it must be what they want.

A very important part of preparation is explaining and selling the program to all supervisory personnel and to the men who will be involved. The men must understand why special instructors are being used, because normally the foreman does his own teaching. When training is done by a specialist, the foreman is still in charge even though he too is a student, learning the things that he needs to know to manage the operation with new equipment.

Here is an admonition for the planners of any training program. Don't teach procedures to be hard and fast

The basic-training program may be used to teach workmen to operate any line of equipment. It could even be used to teach a miner how to help a goat pull mine cars

A training team member gives individual instructions to a man who formerly operated an electrically-powered shuttle car and has been assigned to operate a diesel-powered car in an ore mine

rules. The procedures taught must be followed, but encourage operators, maintenance men and supervisors always to look for better ways to do the job. It is even good to include some aids that these men may use to look for and develop improvements. They should also be well informed on proper channels to follow to get their suggested improvements considered.

Preparations must be made to assure proper condition of both the equipment and work area. Setting the right example is very important. When the operators see the place well rock dusted, a full complement of proper tools, materials stored according to good housekeeping principles and electrical cables and related equipment installed in a workmanlike manner, they will be more likely to respond when they are told that this is the proper way for the section equipment and tools to be kept.

Don't shortchange yourself by skimping on preparation. The confidence gained by the instructors by thorough preparation will carry over to the workmen. Lack of confidence on the part of the instructors will have a like effect on the workmen.

Presentation—Governed by Established Procedure

Presentation is the fourth part of our program. It is governed by an established procedure. In the program for low-coal continuous mining machines the following procedure was followed.

Each shift was started by holding a group safety meeting of workmen, foreman and instructors conducted by either the foreman or one of the instructors. All meetings were of the conference type and the workmen participated freely in the discussions.

After the safety meeting was held the men were given a chance to ask questions about their previous training, then they were briefed on the activities for that particular day. The instructors would explain which members of the crew they would work with and what they expected to accomplish.

Actual instruction, for the most part, was handled individually. That is, an instructor would work with one man at a time using the four-step J.I.T. method in which Step I is *prepare the worker*, to get him at ease, ready to be instructed and interested in learning the job. Step II is *present the operation*, tell, show and illustrate one step at a time. Instruct clearly and completely, but do not attempt to impart more information than the learner can master. Step III is *try out performance*. In this step the worker performs the job while the instructor observes and corrects errors before they become habit. The trainee is encouraged to ask questions about the job. The instructor also asks the learner questions to determine if he knows the why's, where's, how's and when's that he needs to know in order to perform the job properly. Patience is the key to good instruction. Step IV in J.I.T. is *check results*. The instructor continually checks results to help the man gain skill, understanding and confidence. Sometimes reinstruction is found to be necessary.

The instructor must set a good example while the crew is being developed. He must be sure that the prescribed safety tests and other checks are made properly and completely. He can't afford to condone the use of improper tools or accept any job that is short of standard. The things that a trainee sees an instructor do have as much or more effect on him than what he hears the instructor say.

Follow-up—Instructors Revisit Previously Trained Crews

The fifth part of the program is follow-up. After the team is through with a section and is ready to begin instructing another section and another crew, a definite time is set for the instructors to revisit the previously trained crews to check results and reinstruct if necessary.

This checking back has other valuable advantages. It gives the instructors an opportunity to spot areas that need improvement. They find things that indicate another approach should be used or more time should be spent on certain phases of the job. From their observation, improvements are incorporated into the program as the team moves from section to section.

All training programs in both Ore and Coal Mines for teaching operators and maintenance men are derived from the basic five-part program of (1) RESEARCH, (2) PLANNING, (3) PREPARATION, (4) PRESENTATION and (5) FOLLOW-UP.

From this basic program, miners may be taught to drive a team of oxen or to help a goat pull mine cars, or the program can be used to teach men to operate a self-controlled, nuclear-powered coal mining machine of the future.

When a man is taught to do a job, the man must be taught much more than the physical operation of the equipment. He needs to know the purpose of his work and how it fits in with the over-all organization. He must understand that by increasing his productivity, he will put his company in a better competitive position and that this in turn will add to his job security and better his standard of living.

When new equipment is added, top-rate performance is expected. In order to get that kind of performance, the training, too, must be of top-rate quality. The instruction and education given operators must show all members of the organization that top-rate performance is the order of things, from top management functions right through to the actual operation of equipment.

Forest Service Administration of Multiple-Use Land Laws

A former United States Senator discusses the background and administration of laws which permit multiple uses of public lands in the national forests for utilization of minerals and other natural resources

By FRANK A. BARRETT
General Counsel
United States Department of Agriculture

The growth of our states was brought about by the development of our natural resources. The wise use of the resources of our public domain still has a profound affect on the progress and prosperity of every state in the west. The well being of our people demands the continued prudent use of our soil and water, our mining and petroleum, our grazing and timber, as well as our fish, wildlife, and recreational resources on our public lands. The policy of multiple use of these lands is a must for the west.

In early days when we had much more land than people to develop it, the policy was to use a given parcel of land for only one purpose. The mining of minerals was considered more important than agriculture and the Congress directed that lands which were known to contain minerals were not subject to homestead entry and could only be acquired under the mining laws. Mineral development was complicated as a result of the enactment of the Mineral Leasing Act of 1920, which law established an exclusive method for the disposition of oil and gas, oil shale, potash, phosphate sodium and coal.

Millions of acres of public lands were not open for oil leasing because of the existence of mining claims filed on that same land under the Mining Act of 1872, and conversely mining claims could not be located on lands covered by a lease under the Mineral Leasing Act of 1920. The conflict between these two systems operated to retard the development of the mineral resources on the public lands.

Multiple Mineral Development

The first permanent legislation in this field became the act of August 13, 1954, known as Public Law 585, to provide for multiple mineral development of the same tracts of the public lands.

Public Law 585 makes it possible for the Bureau of Land Management to dispose of Leasing Act minerals in lands which are covered by unpatented mining claims located after the effective date of the act. The law provides that a patent to any claim located in the future shall contain a reservation of Leasing Act minerals and related surface rights in land which is covered by a mineral lease, or an application or offer for a mineral lease, or in land then known to be valuable for Leasing Act minerals.

Under Public Law 585 it is possible for a mineral lessee, or an applicant for mineral lease, to obtain a conclusive determination as to whether any person has a valid interest in Leasing Act minerals under the leasehold, because of an unpatented mining claim located before the act was passed. This is done by a formal proceeding in the Bureau of Land Management which must be conducted in accordance with detailed requirements to protect the interests of mineral claimants. If the procedural requirements are satisfied, and the owner of an unpatented mining claim fails to assert an interest in Leasing Act minerals in the manner provided by law, he surrenders the right to prevent the disposal of Leasing Act minerals while his claim remains unpatented. The act also authorizes the location of a mining claim on land covered by a mineral lease, subject to the terms of the lease. It requires the claimant and the lessee to proceed with due regard to the interests of each other, where two operations are conducted on the same land; and provides for judicial relief where the operations of one would endanger or materially interfere with operations or property of the other.

Management of Surface Resources

The second permanent law in the chain of multiple use legislation was the act of July 23, 1955, known as

Public Law 167. Before that act was passed the Forest Service was unable to administer the surface resources of thousands of acres of national forest lands which were covered by unpatented mining claims. The holder of such a claim had the right of exclusive possession, under the mining laws as they had been interpreted. He could not lawfully use the land in his claim for logging or grazing or other purposes unrelated to mining, but he could prevent such uses by anyone else—a situation which prevented development of valuable natural resources. Public Law 167 provided that any unpatented claim located in the future should be subject to the right of the United States to manage and dispose of vegetative surface resources on the claim, and to manage other surface resources (except locatable minerals).

Determination of Surface Rights

The law also established a procedure which enables the Forest Service to obtain a conclusive determination of surface rights in unpatented mining claims located on national forest land before the act was passed. The Forest Service is about half-way through the task of obtaining determinations of surface rights in areas where efficient management of the land and its resources is sufficiently important to justify the expense of such a proceeding.

When the Forest Service has approved an area for "processing" a determination of surface rights, the area is examined for evidence indicating that some person is in actual possession of or engaged in working a mining claim. Each field examiner searches for any house, cabin, camp, mill or other indication of possession; also, for pits, shafts, cuts, machinery and equipment, or other indication of mining activity. He makes an affidavit with respect to his examination, setting forth the names and addresses of all persons whom he has found in actual possession of or working any such land, all as required by the law. He supplements that information with any information he can obtain in the vicinity concerning the names and addresses of absent persons who are known as holders of mining claims in the area.

After an area has been examined, the Forest Service requests the Bureau of Land Management to publish notice of a proceeding to determine the surface rights in that area. The request is accompanied by the affidavits of field examiners with respect to their inspection and findings. It is also accompanied by a certificate showing the names and addresses of persons having an interest in land in the area, under recorded instruments which are shown by county tract indexes as affecting such lands.

The next step is taken by the Bureau of Land Management, which publishes a notice in a local newspaper for nine consecutive weeks, describing the area involved and stating that any claim holder may file a verified statement asserting surface rights in any land in the area, within 150 days from the first publication of the notice.

The Forest Service sends a copy of the published notice by registered mail to each interested person whose name and address have been obtained by a field examiner, or disclosed by a search of tract indexes; and to each person who has filed a request for such notice in the county land records.

Proceedings Involved 553,000 Mining Claims

As of June 30, 1959, the Forest Service had completed the field examination of 444 areas containing approximately 53,000,000 acres, and had made formal request for publication of notice as to such areas. The Forest Service estimates that those proceedings involve 553,000 mining claims, and that about 31,000 of those claims will be included in verified statements in which the claim holder asserts rights to the surface of the claim.

Those figures include 337 areas where the period for asserting surface rights has expired. The Forest Service estimates that such areas contain some 427,000 claims. Less than 13,000 verified statements have been filed, asserting surface rights in those claims, with the result that the Forest Service is now able to administer the timber and other surface resources of more than 96 percent of a total area of 39,000,000 acres because claimants have failed to assert surface rights within the time allowed by law.

It has been the experience of the Forest Service that most verified statements are withdrawn after claimants learn that they won't lose any mining rights which they may have acquired by their mining locations. When a claimant does not withdraw his assertion of surface rights, the Forest Service has his claim inspected by a qualified mineral examiner. If the examiner's report indicates that the asserted rights are valid, the Forest Service executes a stipulation to that effect, and his claims are dropped from the proceeding. The Forest Service made such stipulations with respect to 197 claims in proceedings which were completed before June 30, 1959.

If the mineral examiner's report indicates that a claimant is not entitled to surface rights, he is given a hearing. In cases that were completed by June 30, 1959, only eleven surface claims went to hearing—out of 1585 which had been asserted in verified statements. The surface claims in those eleven cases were held invalid. Of the remaining claims to surface rights 1377 were withdrawn, and 197 were covered by stipulations of validity.

Common Variety Minerals Non-locatable

Public law 167 amended the mining laws in another respect—by providing that a deposit of common varieties of sand, stone, gravel, pumice, pumicite, or cinders shall not be deemed a valuable mineral deposit within the meaning of the mining laws. As a result of that provision, such materials have been non-locatable since July 23, 1955.

Our office is representing the Forest Service in contests which turn on the "common variety" question. We are somewhat bewildered by the number and variety of the substances in dispute. They include pink quartz, volcanic glass, pumice used in making a construction material known as pozzolan—and others too numerous to mention. In many of these contests the principal issue is whether the material has some property giving it distinct and special value. If so, it is locatable. In other cases the controversy boils down to this question: What is common? For example, one claimant has argued that a volcanic substance which blankets the countryside in the vicinity of his claim is uncommon because it is found only in five western states. Right now it looks as if the government and industry have a long, dull, plodding task, requiring patience and common sense, in searching for a workable definition of "common varieties" of nonmetallic mineral.

My office receives frequent requests —usually informal—for an interpretation of various provisions of Public Law 167. For example, we were asked whether the Forest Service may issue a permit for removing common sand or gravel from an unpatented mining claim located after

1955, and we said no. It has since been held in an Interior decision that neither the United States nor the claimant may dispose of sand or gravel on such a claim. Also, we were asked whether the Forest Service or the claimant is entitled to sell timber which is cut on a claim located after 1955, and we said the Forest Service. Interior has not yet published a decision on that question. And so it goes—a stream of requests for our opinion on the effect of this new law.

Mining Claims on Power Site Reservations

The most recent multiple use law is the Mining Claims Rights Restoration Act of August 11, 1955, known as Public Law 359. This law provided that public lands in power site reservations shall be open for the location and development of mining claims. That privilege does not extend to lands in any project operating or being constructed under a Federal permit or license, or to land covered by a preliminary permit issued to a prospective licensee. Under this law the United States retains the power rights in any such land, both before and after patent, and the claimant must assume the risk of being flooded out if the power rights are exercised by the government or its licensee. The act requires the locator of a mining claim to file a copy of his location for record in the local land office. Also, it forbids the locator of a placer claim to commence operations until 60 days after the filing of his notice. During that period the Bureau of Land Management may notify the locator that a public hearing will be held to determine whether placer mining operations would substantially interfere with other uses of land within the claim. If the locator receives such a notice he must suspend operations until the Bureau of Land Management has held the hearing and issued an appropriate order. After the hearing an order is issued which prohibits placer mining or gives general permission for such an operation, or gives permission to engage in placer mining upon condition that the locator shall restore the surface of the claim to its previous condition. If a placer claimant is granted permission to mine upon such a condition, he may be required to post a bond.

The power site law is the latest—but not, I am sure, the last—of the progressive legislation which provides for multiple uses of the minerals and other resources of the public lands of the United States.

ECONOMIC EVALUATION

(*Continued from page 33*)

Again to illustrate the point of certain costs being deferred, the next item includes the pre-operating expenses incurred in the first year. Recall that in the statement of income this amount has been amortized over the life of the project, which is here assumed to be five years.

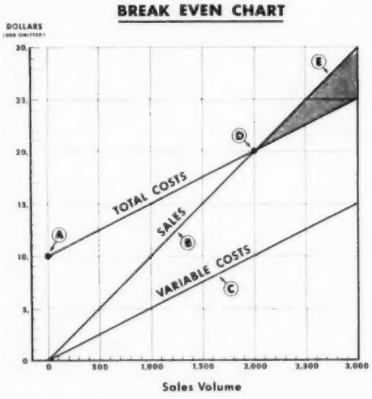
Conventional Financial Statement Obsolete?

The cash flow projection is completed by totaling the funds applied and finding by difference the cash at the end of the period for each of the five years. This last figure can then be viewed by the potential investor to see if acceleration of debt payments should be required in the event cash balances exceed working capital requirements. This also permits determination of what the margin of safety will be for the venture from the standpoint of meeting its obligations.

Bankers are looking more and more to cash flow projections for information which is meaningful to them, and are paying less attention to the conventional financial statements, which include the balance sheet, statement of income and statement of surplus. The conventional statements are useful to provide historical data, but the cash flow projection, if properly prepared, gives the banker information which is important to him in making his decisions. Whether or not you are involved in a new mining venture, I would urge you to make the cash flow statement a part of your normal financial statements.

Exhibit III

BREAK EVEN CHART



Break-Even Chart

The last exhibit to be touched upon is what is referred to as a break-even chart (Exhibit III). This chart is used as a tool for management to make decisions as to the level of production, the price it will charge for its product, or as it more often happens in the mining business, whether or not it can operate under the price structure being forced upon it by market conditions. In preparing this chart it has been assumed that if the company is in operation it will have a fixed cost of $10,000; further, the units being produced are going to be sold at a cost of $10 per unit. Let's look now at what the economic facts of life are with respect to this venture and more specifically, how many units will have to be sold in order to recover the fixed cost, how many units will have to be sold in order to recover their variable cost and what profit can be made in various levels of production. We have assumed that the company may produce anywhere from zero to 3000 units at a variable cost of $5 per unit from its present properties and with its present milling capacity.

Now, the chart illustrates how it can be used to help in making decisions. First, note the total cost at no production or the fixed cost is $10,000 (Point A). Sales (Line B) vary from zero to $30,000 based on the production plotted along the bottom line. Variable costs are plotted on Line C and it can be seen that this line increases as a straight-line because of the assumption that variable costs are $5 per unit.

This chart tells us many things, but the most significant points are the level of production which must be attained to "break even", that is, to pay all fixed and variable costs. As can be seen that is 2000 units or production (Point D). Beyond this point, say 2500 units for example (Point E), the operation is profitable.

Although this is over simplified and has not referred to the many ramifications involved in actual preparation of such a chart, close study will reveal how management can make decisions as to levels of production, costs and sales prices. For example it is reasonably simple to plot the cost lines and then determine the average sales price required at various levels of production by placing the sales line at the total cost line at various levels of production and reading the sales level from the vertical scale of the chart. This sales level can be converted to unit price by dividing it by the production read from the horizontal scale. It is hoped the reader will find this technique useful in his work.

Use of Continuous Mining Equipment in Highwalls

Because heavy stripping equipment and ordinary deep mining methods would not be economically feasible, Harcliff Coal Co. turned to highwall experimental mining in an effort to recover coal that would otherwise be lost

By J. C. FORREST, JR.
President
Harcliff Coal Company

THE subject of this article is "Highwall Mining With a Continuous Mining Machine and the Recovery of Coal That Otherwise Would Be Lost." The system is described as "Punch Mining by the Highwall Method," but operators in Pennsylvania prefer to call it "Highwall Experimental Mining." Punch mining to the writer is, as the name implies, a punch directly to the objective. Harcliff Coal Co., in its method of mining under the laws of the Commonwealth of Pennsylvania, makes a breakthrough for both air and escapeway every 105 ft, and of course this is not included under the writer's definition of "Punch Mining."

Air breaks are the most expensive mining the company has because its continuous mining machine only has a swing of 15°. Driving through a 5½-ft rib on an angle, the machine cuts only on one side at the beginning of the cut. When it is able to get a full bite, the machine is almost through and the inside arms are cutting air instead of coal. If some method were devised to continue on a straight line and right angle the air breaks with the continuous mining machine, it would provide a truly efficient operation.

As to the recovery of coal that would otherwise be lost, this is a fact. In Harcliff's particular area heavy stripping equipment or ordinary deep mining methods would be cost prohibitive and uneconomical.

Good Roof Conditions Spark Idea

Let us consider a little of the background leading up to the acquisition of the continuous mining equipment. Harcliff was in the stripping business. The company added to its line a 36-in. auger-type drill wherein it could drill approximately 100 to 150 ft into the highwall. One day the firm broke through into an old country bank mine and one of its men crawled inside to take a look around. He noted that the roof was standing as it had been left some 20 to 25 years ago. This set management to thinking that with good roof conditions it could use a heavier type machine and make deeper penetrations. A continuous mining machine followed by an extensible belt was visualized.

Despite many adversities the company sold the idea and selected its continuous mining equipment. This consists in the main of a Jeffrey 76 AM Colmol and a Joy extensible belt, power line, cables, transformers, loading conveyors and the like, and entailed a capital expenditure of approximately $300,000. All the mining equipment is a-c on 440 volts.

Harcliff operates in the Kittanning seam of coal and the height varies from a high of 42 in. to a low of 40 in.

Objective—To Drive into Highwall 1000 Ft

After synchronizing delivery of the equipment, power lines, etc. the company commenced to operate on November 26, 1956. This is the worst possible time to start—in winter. December 1 started the hunting season and on December 3 the writer went into the hospital for an examination and never came out until the end of February. On December 14 the company buried the whole "ball of wax" under the highwall and after 16 days of trials and tribulations was able to dig the machine out. The fact that the machine was buried resulted from not staying on sights, which is the most important factor in this type of operation.

The crew consists of eight men including the foreman. The objective is to drive into the highwall 1000 ft. The first hole is drilled 105 ft, the second 210 ft, and so on, until the maximum depth is reached with a breakthrough every 105 ft after the first hole. It took experience to learn to operate and the present crew is capable, efficient and good.

Management likes to maintain a schedule of drilling one hole in two days. To accommodate trucks and equipment, a distance from the highwall to the spoil pile of 70 to 90 ft is needed to give maneuverability. The Colmol cuts 9½ ft and the company leaves 5½-ft pillars or ribs and works on 15-ft centers. Approximately 150 ft of highwall is exhausted per month. A 20-ft barrier is left every ten holes. Prior to a barrier pillar preparations are made for air breaks

Schedule calls for drilling a 1000-ft hole every two days

on both sides—in other words, drilling both right and left so that it will not be too far to make the air break from the barrier pillar.

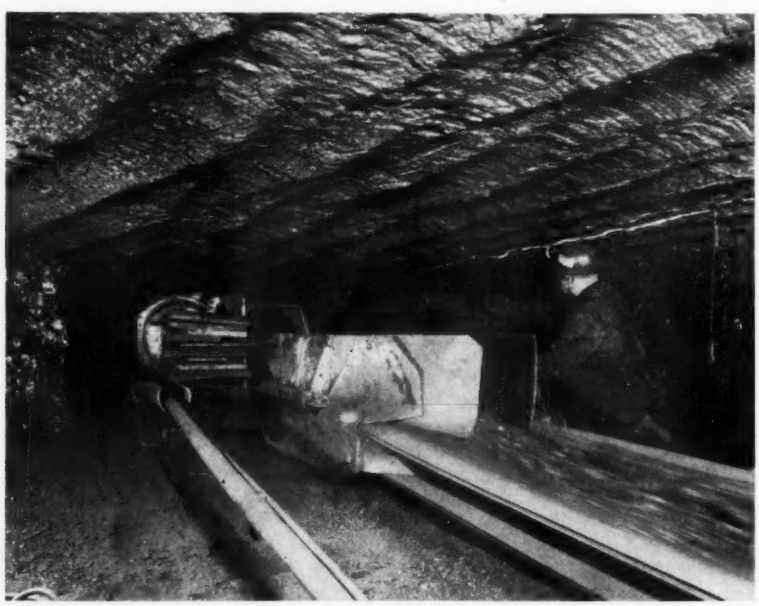
Stay on Sights and Keep Sharp Bits

As to the physical operation, assume the company is set up and ready to drill a new room. Machinery is on sights. The engineer locates a stake directly ahead of the belt drive conveyor on the spoil pile. He also locates a spad at the proper angle with the stake and in the direction he wants the room to be driven. The Highwall Protection Canopy is placed directly in front but a little to the left of the spad in the highwall. The company has two movable sight strings and these are adjusted until they become perfectly in line with the stake and the spad in the highwall. The crew then begins to mine coal keeping the right crawler in line with the sight strings. After advancing approximately 25 ft a chalk line is put on the roof directly above the righthand crawler which would also bring the line directly above and in front of the operator. This method of sighting is continued until the first breakthrough is made. Then two additional spads are installed at this point directly in line with the sight strings on the canopy. This is called advancing the sights and it is done at every breakthrough, back sighting each time to the sight strings on the canopy. Very little time is used to install these spads as they are driven while the continuous mining machine is in operation and kept close to the face. When a new belt is being added, which by the way is done in a minute, the spads are double checked for alignment and this procedure is continued at each breakthrough until the room is completed.

When the room is completed the crew backs up to where the machine was when the last belt was attached and proceeds to remove the entire belt line. As the outside men reel up the belt on individual reels, the inside men follow the belt line out and place the belt brackets and the bottom rollers in the breakthroughs, being careful to place the proper number in each one as they will be picked up from this location from the breakthroughs that will be made from the following room. After the belt line is completely removed and the men reenter the mine to back the Colmol out, the outside crew proceeds to place the head conveyor and the canopy in their proper position for the next room. The belt line is then serviced and by that time the continuous mining machine is outside and it is also serviced. The entire move takes from 3 to 3½ hrs.

In regard to servicing and maintenance, a complete change of cutter bits is made twice a day—at noon and after completion of the day's mining. It is difficult to service the machine while under the hill but the company attempts to do it as far as possible. Bits are checked at every breakthrough and all bad bits replaced. A very thorough check is given as far as oil and grease are concerned after the equipment is removed from each working place and brought to the outside, which is on an average of three times a week. The bits are also completely changed at that time regardless of their condition. There are two important things in this type mining; one, that you stay on sights and two, that you keep sharp bits.

As far as timbering is concerned, the company does very little but does set two posts at every breakthrough, except at the barrier pillar where four mine posts are set because of the greater area exposed.



All mining equipment is a-c

ECONOMICS of Various Types of Quarry Haulage

Loading a 35-ton side dump iron ore carrier in a Minnesota open pit. Two great advantages in truck haulage are flexibility within the pit and ability of the machines to negotiate grades of eight percent or more

The potential for cost-cutting offered by modern haulage equipment dictates that the progressive operator determine whether his present haulage system is the cheapest and most efficient

By ORRIN D. WEEKS
Plant Manager
Calaveras Cement Co.

DURING the past two decades, but especially since World War II, development of both machines and methods for cheaper pit mining has been spectacularly rapid. Adoption of new primary drilling tools—and rotary drills using tricone bits, large diameter percussion drills, whether activated by top-of-stem or down-the-hole motors, and the jet-piercers—has gone a long way toward replacing the old standard churn drill. Acceptance of ammonium-nitrate blasting agents for loading primary blast holes in sizes over 3 inch diam has been almost unanimous and has resulted in cost reduction to as little as 25 percent of what it had previously been, all in the last five or six years. Rock loading machines have also been greatly improved, chiefly by increased size, which allowed lower unit costs of labor, but also by better engineering and better material applied to their manufacture. Improvements in other quarrying tools such as tractors and secondary breaking machines has been just as rapid, and at many operations has contributed to a better cost picture.

All of these facts are well known within the industry. They are well known because of the wider range of operations, within the industry, which have been able to adapt these developments to an economic advantage. The smaller pits, generally industrial mineral producers, have been benefitted as well as the giant operations in coal-stripping and in both ferrous and non-ferrous metals.

Adoption of Haulage Improvements Slow

The subject of quarry haulage is quite another matter. A small-scale, piece-meal, and low-capital-outlay change of haulage system at an established operation is usually impossible. The decision to make a change rarely can be based on either experience or experimentation under the conditions of the job in question. For example, placing one large off-highway type truck in a pit in an effort to determine the feasibility of converting to truck haulage from an existing rail system would be pointless, because of the impossibility of duplicating conditions such as length of haul, grade of roads, surface condition of roads and operating flexibility within the pit which would be provided at the time of a change-over. Rather, an effort must be made to extrapolate the results as observed or reported from other situations. This, of course, is an extremely difficult and risky procedure.

For these reasons, application of equipment and methods developed in recent years for moving "rock-to-the-box" has been nowhere near as broad as it has been for the new tools for other phases of the quarrying industries—yet the means for better haulage has been provided. Improvements in trucks, belt conveyors, scrapers and rail equipment have been continually evident. In addition, new methods such as inclined skipways and self-loading transporters have come into limited use, but are undoubtedly on their way to much broader application.

To a large extent, utilization of the improved transporting equipment through recent years has been by the big operations. Or, perhaps more accurately, the big operations, faced

with an imperative need to cut costs, demanded better tools and this need spurred the efforts of manufacturers resulting in the present improvements. To give credit where due, we should also remember that the requirements of the construction industry always have a great and positive influence on the development of this type of machinery—and for this we thank them.

However, the potential for cost-cutting offered by the modern haulage equipment now available dictates that the progressive operator, large or small, make the effort to determine whether his present haulage system is the cheapest and most efficient for his particular conditions.

This can be determined only by a detailed and painstaking investigation. One logical approach is to divide the study into four sections which will be planned to:

I. Determine the characteristics of each possible haulage system
II. Determine the characteristics of the particular quarry operation under study
III. Eliminate, by inspection, certain haulage systems due to obvious incompatibility between sections I & II
IV. Select the best method, from the remaining, by detailed cost analyses

It would be impossible within reasonable limits to discuss, or even list, all of the pertinent characteristics of all possible quarry haulage methods. The following is intended merely as a brief sample of what would be required in an actual investigation.

I. HAULAGE METHODS

Quarry Rail Haulage—Under the right conditions, rail haulage is frequently difficult to beat from a cost standpoint because both labor and maintenance charges can be very low per ton of material moved. However, in deep pits, this cost advantage can be depreciated, or entirely lost, due to the long haul imposed by the three percent grade limit and by the excessive waste stripping necessary to provide haulage routes for exploitation of ore from deep benches. Rail haulage is best applied to an extensive deposit of which horizontal dimensions are large relative to the vertical, which is quite uniform in quality and which will be mined at a large daily tonnage. Rail transportation will generally show relatively good costs when the haulage distance is long.

Truck Haulage. Today's specialized-off-highway type quarry truck (predominately end-dump) is a much improved and tougher piece of machinery than was available a few years ago. Nevertheless, haulage costs with trucks are not necessarily low. The money needed to purchase a fleet of these machines, build roads for their operation, and provide shops and warehouses for their upkeep, will be substantial. Additionally, both operating and maintenance costs are relatively high because of the large crew of skilled or semi-skilled workmen required.

The great advantages of these machines lie in their ability to operate on grades of eight percent and at times of twelve percent or more, and their flexibility within the pit, where they can be quickly shunted from ore to waste shovels as necessary. They readily lend themselves to disposing of contaminated ore, boulders or deleterious material from a production shovel, and also to following a shovel into difficult and irregular areas of the pit bank. As compared to rail, trucking allows for substantial savings in waste to ore ratios, but is less well adapted to long hauls.

Belt Conveyors. A modern, well-engineered conveyor system generally will show low operating and maintenance costs per ton of material handled, but the first cost is not low. It can be operated on slopes up to 18° (that is 30 to 32 percent). Where it fits the characteristics of a deposit, belt conveying can be a very effective transportation system, but because of inflexibility within the pit, need for auxiliary or shuttle haulage to feed the system, limit in size of material handled and vulnerability to primary blasting it must be considered only as a special application. Additionally,

This limestone and shale quarry points up to the fact that transporting rock often poses haulage problems with related cost considerations which justify careful study as to haulage methods. Eventually material will be elevated over 400 ft from the lowest level to clear the pit, then moved six miles to the plant

first costs, operating costs and maintenance costs all soar rapidly on long conveying systems since extra drives, tension take-ups and transfer points add materially to all costs.

Inclined Skipways. The skipway, long used in mining, has recently been spectacularly revived, modernized and adapted to today's pit requirements. Original capitalization is quite high, especially since the skipway must be augmented by shuttle truck haulage from shovel to loading point. Operating and maintenance cost are reportedly quite moderate.

Good features of the skipway are that it lifts rock from a pit more directly and quickly than any other system. It can be extended as new benches are developed and multiple-bench loading points can be used. Capacity of skip is designed to match that of shuttle trucks. Any material which can be loaded into the trucks can be transferred to the skips. Since the skipway can be laid on slopes of up to 45°, little or no extra stripping is necessary in most pits because the mean, final bank slope seldom is much steeper than 1 : 1. Waste as well as ore can be handled through the system.

High first cost and high tonnage potential will tend to restrict use of these installations to the larger operations.

Scrapers. The revolutionary jump from the old horse-drawn slips and Fresnos to the modern carry-all scraper is a mighty one. These machines are very efficient and low-cost for moving soft, unconsolidated and non-blocky material for short distances, say up to 2000 ft maximum. "Pushers" add appreciably to speed and effectiveness through the loading cycle. The powerful rubber-tired tractors now available are especially good for this purpose. Models are now in use with capacities up to 70 tons. Scrapers can never be considered, of course, for use in hard, blocky, blasted rock, where the haul distance is great, or on long, steep grades.

Self-Loading Transporters. These machines have only very recently come into the picture and up to the present time should probably be considered as in the development stage. They are crossbreed between the underground mucking-machine, the overhead loader and the shuttle truck. Models now in use or being developed are both track and tire mounted. In theory, these units can be operated in short-cycle haulage situations as are shuttle trucks but, being self-loading, eliminate the cost of owning, maintaining and operating a shovel. Use of these machines will always be restricted to short haulage radius conditions, probably not more than a few hundred feet. Material handled will have to be naturally soft and fine or else of such character that it fragments well in blasting. However, under the right conditions, and especially for low-tonnage operations, these units may offer a very effective application.

In deep pits, any cost advantage of rail haulage can be lost because of the long hauls imposed by grade limitations and waste stripping necessary to provide haulage routes

Others. There are other rock-product transporters such as the aerial tramway and slurry pipe line which might be discussed. In general these are specialized installations for moving material long distances away from a quarry or pit rather than within the production area. It might be worth remarking that one manufacturer has plans for moving large, blocky, run-of-quarry material downhill for considerable distances over a series of unusually long apron feeders.

II. QUARRY CHARACTERISTICS

The primary function of a haulage system, of course, is to provide a smooth, regular and reliable flow of material from quarry to plant. Therefore, in studying the characteristics of a given quarry operation in an effort to select the best possible haulage system for that particular application, it is imperative to understand thoroughly the type and size of the loading method to be employed and the nature of the dumping point, so that haulage will fully conform to the capacities and fluctuations of these two facilities. Hourly, daily and yearly production needs must be determined and, to whatever degree possible, the requirements of future expansion should be anticipated and provided for.

Detailed information on the dimensions, configuration and homogenity of the deposit must be accurately known. The physical characteristics of the raw material in the state in which it will be hauled, including consideration of all weather conditions, is a very important factor. Additional planning will be necessary if more than one material must be handled.

The method of mining to be employed is important, particularly so in considering the necessary flexibility of the haulage set-up. The distance the rock must be moved, type of terrain to be crossed and whether or not delivery must be made to more than one point, such as plant and waste-dump, will affect the final decision.

A last consideration, which is easily overlooked, is whether or not skilled and semi-skilled labor forces are available and what cost will attend providing living accommodations in the event that the haulage system selected requires extra man power.

III. ELIMINATE INCOMPATIBLE SYSTEMS

Once the information in sections I and II is carefully assembled, a simple, logical inspection of the facts at hand will usually eliminate all but perhaps two or three of the haulage

systems listed in section I as being incompatible with some of the characteristics of section II. Each of the remaining methods could then presumably do the job. The final choice must be the one which can be shown to be the most economical.

IV. SELECT METHOD BY COST ANALYSIS

The final selection, from among the applicable haulage methods spotlighted in section III, must be based upon a detailed and reasonably complete engineering layout of the quarry and haulage system for each separate method. This plan must show not only the beginning and end points, but should include the rock and waste tonnages at successive levels of the pit, together with changes in approaches and pit utilities at various stages in the operation. This admittedly requires a large amount of engineering by experienced personnel. But there is no easy way to come up with figures precise enough to allow for making the correct decision.

The next step, of course, is to total up the capital cost of the equipment installations, and developments required for each system. The variations, such as relative waste stripping ratios, lengths of roads and approaches, often are so large as to be the most critical item in the analysis. This, basically, is why I emphasize the importance of the engineering study. We all recognize this, but do we always follow through?

Most mining engineers are more or less familiar with the standard methods of computing operating costs. For studies such as these every phase of the haulage process must be included in detail. Acceptance of "shotgun estimates" can be disastrous. Reliable figures must include full allowance for maintenance, for actual operating time and for unexpected contingencies.

To attain a complete figure for these costs, realistic consideration must also be given to the expense of financing the proposed change.

With the accumulation of this information the operator should then be able to pick the most economical system, and on an existing operation determine whether the payout justifies scrapping the presently used facility for a better one.

Last Frontier in Mine Economics

In my mind haulage can be described as the "last frontier" of the mineral industry's cost sheet. Most mineral producing enterprises by now have either taken advantage of the cost-cutting developments of recent years in the other phases of quarrying or have determined by experimentation that these tools and methods offer no savings for their particular job. However, the parallel advances in material-moving processes, being more difficult to test-out, have been nowhere near so broadly adopted.

It might be said that haulage, like the frontier to our pioneer ancestors, beckons the cost-conscious quarryman with a promise too poignant to be ignored but too nebulous to be taken for granted. The only course possible is to undertake the rather laborious and painstaking effort which will allow for an intelligent decision as to which is the one best haulage installation. But, as with the pioneer facing up to the rigors of the journey west, the pay-off can be very rewarding.

MINE MECHANIZATION

(Continued from page 44)

ness, and this dimension placed a severe height limitation on the equipment. Also, the dip being flat (7°), and with levels at 100 ft intervals, there is a horizontal distance of approximately 1000 ft between operating levels. A type of loader that could also effectively tram this distance so as to limit the number of men employed in loading to one man per unit was wanted. If a loader and small trucks were used, two or three men are required. Further, we did not want to go to the expense of costly footwall drifts and raises for sub-level ore transfer to reduce the distance an ore loader must tram. A footwall cross-cut 500 ft in length, which contacts no ore costs more to drive, in order to provide an intermediate loading point, than a modern piece of loading equipment with an adequate operating range. Finally, we wanted to keep mine development within one of the several ore horizons, and needed loading equipment that could cope with the changing conditions and variable grades of the irregular ore occurrence.

Three Types of Loaders in Use

While several types of loaders have been tried and many other considered, the equipment now in use represents substantial modification and improvement over the original.

Presently, three types of loading equipment are in use. The crawler mounted Eimco 630 is used for loading development rock from drift headings, and for the initial opening of stopes to sufficient size for use of a Payloader. It is good for tramming distances up to 50 ft from the mine car. This type of equipment loads four to five percent of the mine tonnage.

For the first major production from stoping areas the rubber tired Hough Payloader model H-H with the heavier front axle and strengthened steering knuckles is used. This type of equipment loads directly into four ton mine cars, and is efficient on tramming distances up to more than 300 ft. This type of equipment loads approximately 60 percent of the mine tonnage.

For long trams up to 800 ft or more the company is using the rubber tired Transloader and its predecessor, the Gismo, which does not have as efficient tramming range as the Transloader. One limiting feature of this equipment is that it cannot dump directly into the mine cars. Some special dumping facility such as a ramp, raise or ore pass in required for its use. This type of equipment is presently loading about 35 percent of the mine tonnage, but this figure is expected to increase as mining progresses.

Loading costs for the last six months averaged $0.36 per ton. This figure includes all labor, fuel, service, maintenance and spare parts. It does not include depreciation. The average tons produced per man on ore loading approximates 170 tons.

Servicing Equipment

In order to properly service and maintain the mechanized equipment for the 2000 tpd operation at the Jefferson City mine, a maintenance crew of nine men and a foreman is required. An extensive underground shop has been provided and all maintenance work is done underground.

It was found that fueling and lubrication of the equipment was becoming a real problem as the mine spread out through the progress of mining. To overcome it a special diesel powered fuel truck, which is literally a travelling service station, is now used. It is also used to pick up drill steel for sharpening.

Frequently, when equipment breaks down it is more economical and practical to make the repairs at the point of breakdown. To facilitate this, we have a diesel powered service truck to transport tools, men and equipment to make repairs on equipment away from the underground shop.

Standard Roof Bolt Anchorage Testing Procedure

A REPORT OF THE AMC COAL DIVISION COMMITTEE ON ROOF ACTION

FOR some time the Committee on Roof Action of the American Mining Congress has been working to establish a universal test to provide a measure of the "anchorability" of different anchoring devices in a particular stratum. The procedure suggested in this report is the result of two years of experimentation and much discussion between many segments of the coal mining industry.

It should be pointed out that many companies perform roof bolt pull tests for various reasons and that the method of testing may differ widely between companies, and within companies, depending on the reason for the test. The test proposed by the AMC Committee on Roof Action is meant to serve as a guide for individual companies. Results based on the proposed standard procedure can be accepted at face value, and compared even though they may have been obtained by different personnel and in different mines. Such comparisons have not been possible in the past.

The proposed testing procedure is based on the premise that the best way to compare data obtained from anchorage tests is to compare the slopes of load-displacement curves over a portion of the curves for which the bolt load and the jack load are equal. When plotting a load-displacement curve from data collected in a roof bolt pull test, three distinct portions are usually apparent—(1) the portion between the initial application of jack load (no displacement) and the point at which the jack load and the bolt load become equal; (2) the center position, usually linear, up to the point at which the curve starts to flatten, and (3) the flattened out portion.

The procedure outlined in this report has been tentatively accepted as a standard by the Committee on Roof Action of the American Mining Congress. Its final adoption has been delayed until the March 1960 meeting of the Committee to allow field testing of the procedure. Comments from interested parties are invited.

The first part of the curve has no significance other than to indicate the point at which the jack load and bolt load become equal. It is the center portion that is the important one —the portion over which jack load and bolt load are equal. The line of demarcation between the first two parts of the curve is characterized by a definite "knee." It is not as easy to determine where the center part of the curve stops and the third part begins, and it is usually a matter of individual judgment. The most important thing is to realize that this point signals the loss of "anchorability."

Test Procedure

1. Drill hole in normal manner.
2. Measure hole diameter at anchorage level.
   (In comparing the performance of expansion units, in various strata, or in comparing performance of various expansion units in the same strata, it is important that variations in hole diameter at the anchorage level be taken into account.)
3. Assemble pulling collar, washer (if used), plate, header (if used), palnut (if used) and expansion unit on bolt and insert assembly into hole.
4. Tighten bolt in normal manner.
   (This step can be varied to suit the particular reason for making the test, and it may be desirable to tighten the bolt to a predetermined value.)
5. Place testing equipment on collar so that the pulling column bears directly on the bearing plate, making sure that the jack load is parallel to the axis of the bolt.
6. Apply 1000-lb load on hydraulic ram.
   (The 1000-lb figure is arbitrary and could be less, depending upon the smallest dial division of the pressure gauge, but in no case should the initial load be greater than 1000 lb.)
7. Place extensometer in position between end of pulling rod and mine floor.
8. Increase load on ram, recording displacement of bolt head in 0.001 in. at each 1000-lb increment of ram load.
   (The displacement can be measured at less than 1000-lb increments if desired, but the increment should not be greater because enough points are needed to assure an accurate graph.
   (A possible variation of the pull test is to install a hardened washer between the pulling collar and the plate for determining when the jack load equals the bolt load. This can be determined by tapping the washer as the jack is increased, noting the load at which the washer first becomes loose. Before the washer is loosened, of course, the jack load does not equal the bolt load.)
9. Continue loading until there is continued displacement without an increase in load, or the yield point of the bolt is reached, whichever occurs first. That

point at which there is a large displacement without a corresponding increase in load can be considered to be the ultimate anchorage capacity of the unit.

10. Release load and remove equipment.
11. Plot results to determine graphically installed load, and anchorage capacity, using the X axis for displacement and the Y axis for load.

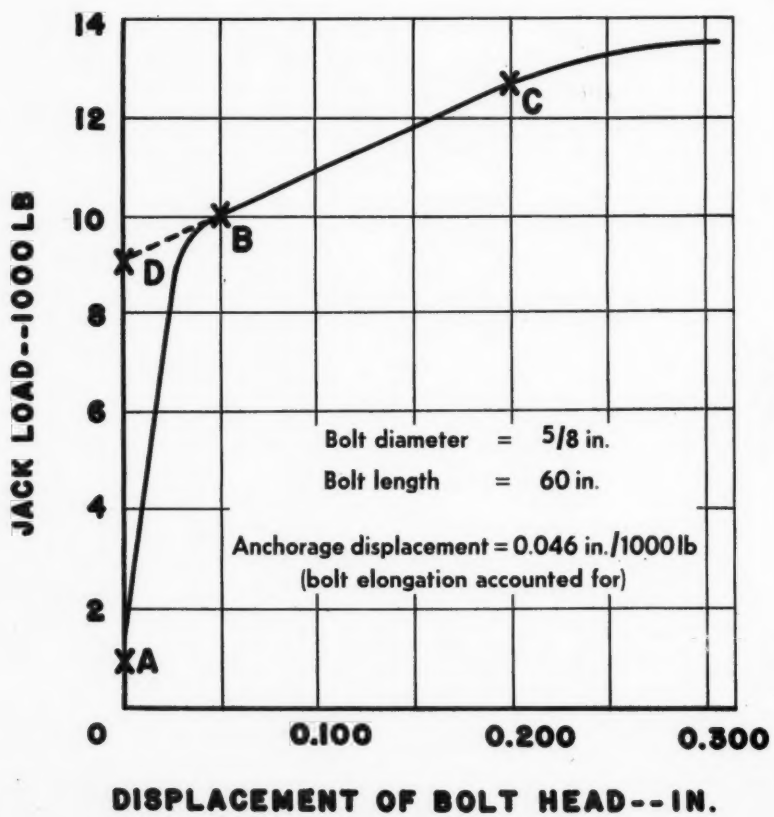
    (A close approximation of installed load can be obtained by projecting the slope of the center portion of the curve back to the load axis of the graph, the Y axis; reading the value at the point of intersection.)
12. Determine displacement in inches of movement per 1000 lb of increaser load. This can best be done by fitting a straight line to the center part of the curve and calculating the reciprocal of the slope of this line.

    (It should be remembered that anchor movement and bolt head movement are not the same, and that it is bolt head movement that is measured by the extensometer. To find the true anchorage displacement, which is the basic goal of the test, the elongation of the bolt and pulling rod at each increment of the load must be subtracted from the measured bolt head displacement at that load. If tests are being conducted using bolts having the same diameter and length, it is possible to make a true comparison of performance without compensating for elongation, because it would be the same in each case. However, it is impossible to make a true comparison of the performance of the anchorage if bolts of different lengths and/or diameter are used unless bolt elongation is accounted for. In any event, a definite note should be made on the graph as to the length and diameter of the bolt and whether or not elongation has been deducted.

    (For those who wish to account for bolt elongation, Table I shows elongation per 1000 lb of load. In theory, the elongation of the pulling rod should also be taken into account. However, because this figure is so small, it can be ignored for the purpose of this test.)

Table I. Elastic Stretch Values for Mine Roof Bolts

Bolt Length	Elastic Bolt Stretch per 1000 lb (to the nearest 0.001 in.)	
	5/8-in. Bolts	3/4-in. Bolts
24 in.	0.003 in.	0.002 in.
30 "	0.004 "	0.003 "
36 "	0.005 "	0.003 "
42 "	0.005 "	0.004 "
48 "	0.006 "	0.004 "
54 "	0.007 "	0.005 "
60 "	0.008 "	0.006 "
66 "	0.009 "	0.006 "
72 "	0.010 "	0.007 "
84 "	0.011 "	0.008 "



Sample load-displacement curve for 60-in. long, 5/8-in. dia. roof bolt

Example

Attached to this report is a sample load-displacement curve. The critical points are labeled and can be identified as:

A. Point at which the jack load begins to be transferred to the bolt. (It can be assumed that up until this point slack is being taken out of the test equipment.)
B. A point at which the jack load and bolt load are the same.
C. Another point at which the jack load and bolt load are the same.
D. A close approximation of the installed bolt load.

It is the center part of the curve—line BC—that graphically represents bolt head displacement per thousand-lb increase in load. From the curve the rate of displacement is calculated to be:

$$\frac{0.200 \text{ in.} - 0.048 \text{ in.}}{12{,}800 \text{ lb} - 10{,}000 \text{ lb}}$$

or

$$\frac{0.152 \text{ in.}}{2{,}800 \text{ lb}}$$

or

0.054 in. per 1000 lb

To remove the effect of bolt elongation, assuming that a headed 5/8 in. diameter 5-ft long bolt is being tested, subtract 0.008 in. per 1000 lb, obtained from Table I. That is, the true anchorage displacement (0.046 in. per 1000 lb) equals the bolt head displacement (0.054 in. per 1000 lb) less the bolt elongation (0.008 in. per 1000 lb).

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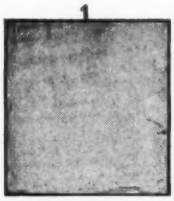

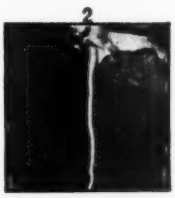

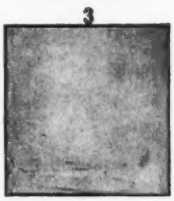

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Shovels, draglines, etc.	plain and anti-friction	high temperature, heavy load, wet, dirt	Replaced lithium greases.
Drilling rig	plain and anti-friction	high temperature, heavy load, wet, dirt	Replaced lithium greases.
Conveyor outside tipple	anti-friction	— — — — —	Permits cold weather start-up without knocking out breakers.

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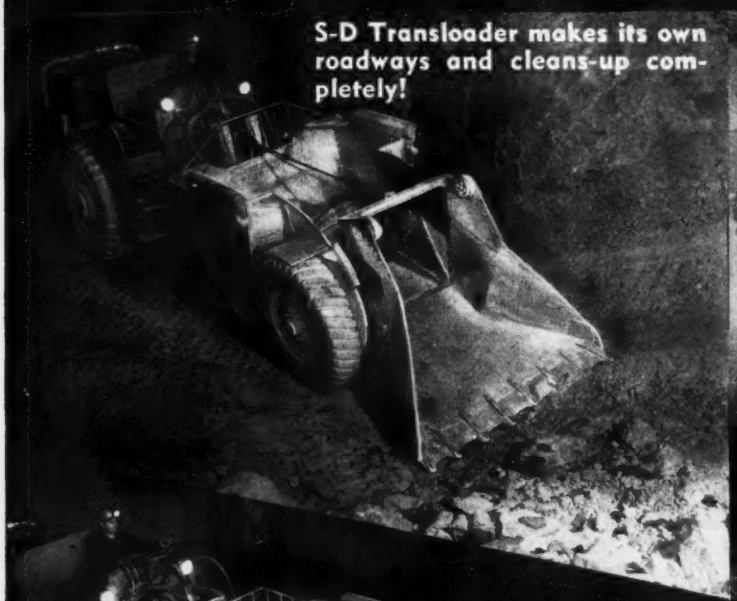

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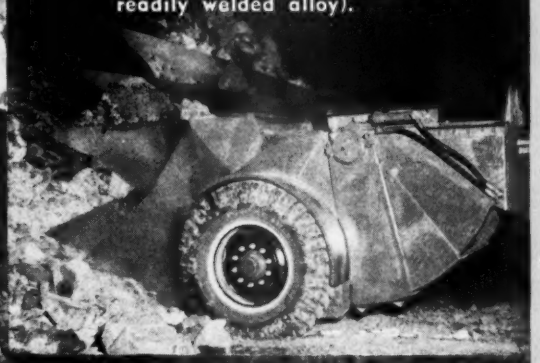

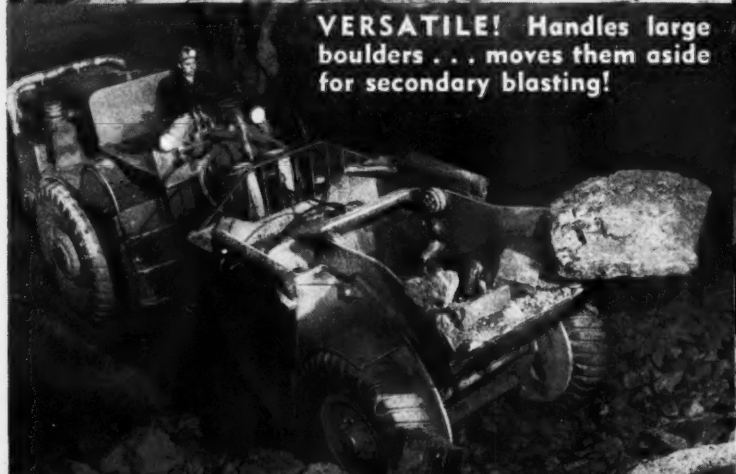

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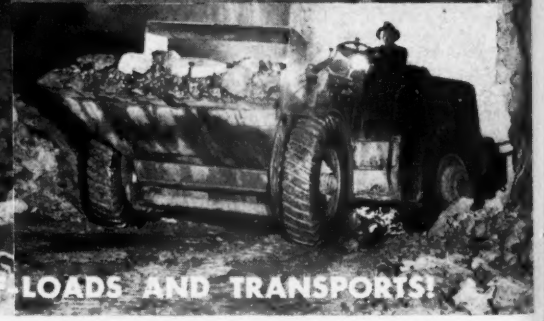

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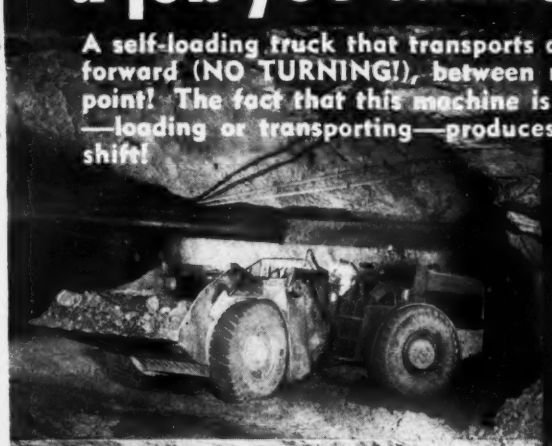

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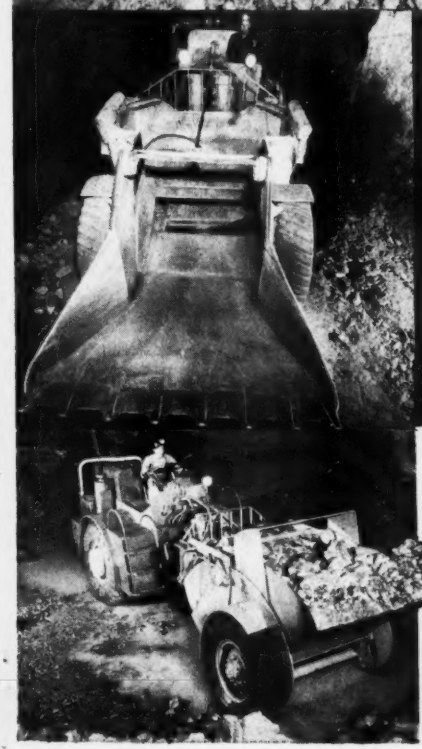

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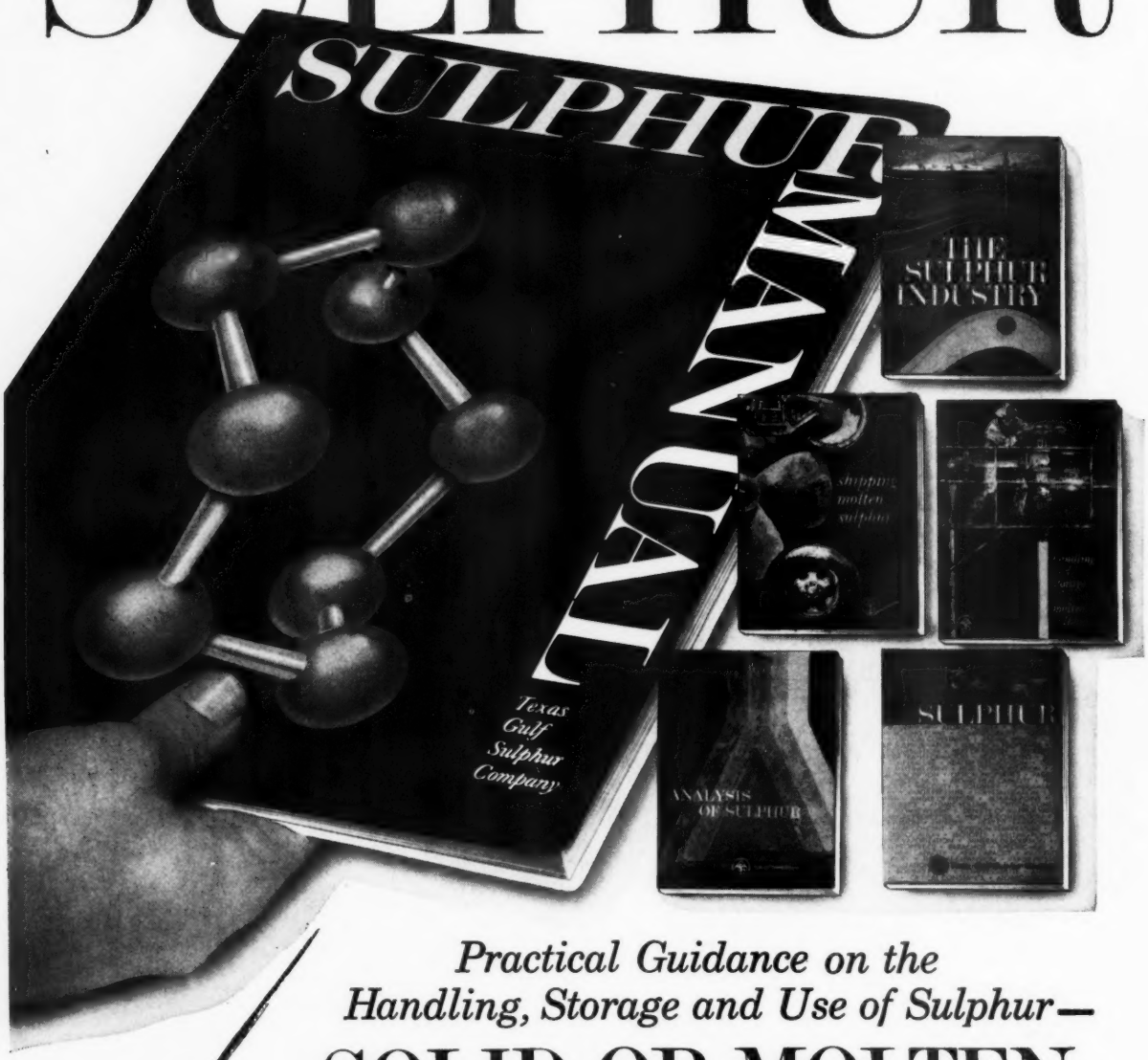

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AMC COAL DIVISION

Holds 25th Annual Conference

ON November 5 the Coal Division of the American Mining Congress gathered at the Penn-Sheraton Hotel in Pittsburgh, Pa. for its 25th Annual Conference. A record-breaking crowd attended as representatives of coal producing companies and manufacturers of mining equipment crowded the meeting rooms to hear and discuss the technical problems currently occupying the attention of the coal industry.

The day-long meeting was highlighted by a luncheon at which the Honorable James G. Fulton, Congressman from Pennsylvania, addressed the crowd on the general subject, "Congress and the Coal Industry." Jesse F. Core, Vice President-Coal, U. S. Steel Corp. and Chairman of the AMC Coal Division, presided.

Congressman Fulton complimented the coal industry on the tremendous job it had done of holding the price line in the face of rising costs from every direction. However, he said, the industry could not make further progress by resting on its laurels, but should continue to show the same vigor that it has in the past. In discussing coal research, he urged everyone in favor of the passage of a coal research bill, which he predicted will be considered in the next session of Congress, to write his Congressman. Never underestimate, he said the value of such a grass-roots approach.

Coal Division Activities

During the year Coal Division Committees have been active on many fronts. Individual groups have considered subjects ranging from standardization of aptitude tests, and their interpretation, to methods for improving temporary splices in underground trailing cables. As the studies are completed they will be made public to the industry through articles appearing in Mining Congress Journal.

Following is an account of the reports presented in Pittsburgh:

COMMITTEE ON UNDERGROUND POWER

JAMES A. ERSKINE, Chairman

JAMES A. Erskine, chairman, briefly reviewed the activities of the Committee on Underground Power during 1959 before calling on O. J. Swanson, chairman of the Subcommittee on "Recommended Standards for A-C Systems and Equipment in Coal Mines." Swanson explained that, with the rapidly growing use of a-c in coal mines, the U. S. Bureau of Mines had proposed a set of voluntary standards. The Bureau furnished copies of these standards to the Power Committee at its March meeting and asked for suggestions. A subcommittee was appointed which reviewed the standards and suggested some revisions. The revised standards were submitted to the Bureau, which subsequently approved practically all of the changes. Swanson commented that the industry will find the recommended standards to be a very useful guide representing good engineering practices in the use of a-c.

Upon completing his report, Swanson called on Larry Harrison of the U. S. Bureau of Mines for any comments he cared to make. Harrison said that the recommended standards would be published in the form of an information circular. Included in the publication, he said, would be some general discussion and information on a-c systems. Also, illustrations, diagrams and photographs will be used to show a-c equipment. One section will be devoted to a definition of terms used in the text and a bibliography of related subjects will be included.

* * *

E. G. Sturdevant reviewed the progress to date of his subcommittee on "Temporary Cable Splices." During 1958 one temporary splice was made in a trailing cable per thousand tons of coal produced from underground mines. These 300,000 splices represent 75,000 hours of lost time if it is assumed that it took 15 minutes to make each splice. The loss in man-hours would be greater, of

At a luncheon meeting, filled to capacity, Congressman James G. Fulton pointed out the importance of having a National Fuels Policy

course. It is easy to see that any reduction in the time taken to make a splice would be of benefit to the coal industry. The subcommittee has come up with a list of recommendations—primarily the suggestions of cable manufacturers but based on a program of testing splices that were supplied by mine operators—which was presented for review and comment by the industry.

The next report, presented by Mike Kopchik, had to do with "Cable and Cable Accessories for A-C Mining." The subcommittee is preparing a report on this most important subject, including the gathering of information on available high and low-voltage cable, cable connectors, cable construction, and tables on current carrying capacities, resistance and reactance. Several "stumbling blocks" have been encountered, such as mine power cable which includes an insulated ground check conductor. In this case, the subcommittee felt the subject could be handled most ably by IPCEA Group, Committee 13 on Portable Cords and Cables. It will prepare complete specifications on a revised type mine power which includes the ground check. The question of size will also be discussed. Once this information has been obtained, it can be incorporated into the subcommittee's report. Other stumbling blocks are being worked on and the subcommittee hopes to have an initial report to present to the Committee on Underground Power before long.

* * *

John Buss, chairman of the Subcommittee on Permissibility Problems, spoke briefly on some newly proposed Bureau of Mines schedules; including Schedule 25B, which covers dust collectors; Schedule 31 covering diesel equipment in gassy non-coal mines, and Schedule 30 on flame resistant hydraulic oil.

COMMITTEE ON UNDERGROUND HAULAGE

A. G. GOSSARD, Chairman

DAVID E. BAYER and Benjamin A. Tudor pooled their experience to report on the important factors in determining a choice between rigid type and cable suspended conveyors. The first paper, by Bayer, outlined some of the advantages of rope side-frame conveyors, including lower cost, ease of installation and resilient mountings. Expanding on these advantages, he said that lower first cost means that less of the company capital needs to be expended for the initial purchase and many installations which might not otherwise be economically feasible would become so, and the use of the belt conveyor could become more general underground. Ease of installation can be expanded to demonstrate that there is less material to handle, more working time available and that special mining systems are made practical. Resilient mounting means extended belt and idler life, while at the same time reducing spillage by reducing impact of the loads meeting the idler.

Bayer used several examples to illustrate the capabilities of this type of conveyor and to emphasize that if rope frame belts are installed with the same workman-like manner; the same care; the same installation specifications as set forth by the experience that the industry has had with the rigid-type conveyors, and fully protected by all the safety devices that have been developed and are required; then there is no reason why it will not give equally satisfactory performance to satisfy even the most exacting operator.

* * *

Richard Williams presented the paper authored by Ben Tudor which covered some of the problems encountered with rope belt conveyors. The report described one company's experience with the suspended, chain-link idler-type of rope belt conveyors.

* * *

The Committee on Underground Haulage also announced the availability of a Turnout and Curve Data sheet, which had been submitted by Earl E. Roecker. Many requests for information regarding location of points on a rail turnout or curve have led to the compilation of this data sheet. It is being submitted to the industry for comment and will be incorporated in the handbook on "Construction and Maintenance of Rail Haulage Roads in Coal Mines" when it is next revised.

COMMITTEE ON STRIP MINING

EDWIN R. PHELPS, Chairman

JAMES A. Miner, chairman of the Subcommittee on Recommended Safe Practices for Handling Ammonium Nitrate, briefly reviewed the progress of this group to date. It is estimated that some 280,000,000 lb of ammonium nitrate blasting agents is

being used each year. Because of the tremendous amount of the material being mixed, handled, transported and stored by thousands of persons in many and varied mining and construction projects, the U. S. Bureau of Mines has been working on a set of recommended safe practices for field mixed ammonium nitrate blasting agents.

The fact that tentative recommendations were being written was called to the attention of the Committee on Strip Mining at its spring meeting in Evansville, Ind. A subcommittee was appointed to review the recommendations to ascertain their effect on the coal mining industry. This subcommittee, composed of representatives from chemical companies making ammonium nitrate, explosives companies and mining companies, met several times during the year and has approved most of the recommendations—in some cases with minor changes.

COMMITTEE ON ROOF ACTION

J. ALLAN BROOKES, Chairman

TO guarantee standard interpretation of roof bolt pull tests, a common method of testing is needed. For some time the Subcommittee on Standardized Roof Bolt Pull Testing Procedures has been working toward the establishment of such a standard. James Scott presented the test as now proposed by the Committee on Roof Action, the full text of which appears on page 59 of this issue of **Mining Congress Journal.**

* * *

Raymond W. Gibson reported on "Roof Bolt Reclamation." The subcommittee looking into reclamation procedures has agreed that the four primary factors to be considered in the use of recovered bolts were excessive flexure (bending), torsion failure, thread damage, and bolt head damage. However, in regard to excessive flexure, it is generally agreed that the possibility of excessive bending causing a serious hazard in the use of recovered bolts could be discounted, based primarily on rather exhaustive tests carried out by the U. S. Bureau of Mines and reported in R.I. 5408 by Frank L. Gaddy.

The subcommittee made the following recommendations:

1. That where roof bolt recovery is practiced, a very stringent set of safety rules be established, governed by local conditions, and that these rules be given strong emphasis throughout the working force.

2. That careful visual inspection be made of all recovered bolts, particularly for evidence of torsion failure, thread damage, flexure cracks, or tensile failure. If evidence of any of these are found, the bolt(s) should not be reused.

3. That the practice of chasing recovered bolt threads be discontinued, and that the threads be cleaned with a wire brush only, then oiled; subsequently, if the expansion shell will not follow the threads, the bolt should be discarded.

4. That the entire matter of roof bolt recovery be left open for further consideration, and that members of the industry contribute their experience at future meetings to enable a more adequate evaluation to be made.

* * *

COMMITTEE ON MECHANICAL MINING

J. A. YOUNKINS, Chairman

FOLLOWING lunch the Committee on Mechanical Mining made its report to the Annual Coal Division Conference. The first group to discuss its work was the subcommittee on "Face Ventilation for Continuous Mining."

A. E. Condon presented the report. For the past several years, the subcommittee has endeavored to gather information on the various methods being tried and used, both with success and not so successfully, to increase the safety factor at the working faces both with continuous mining methods and also conventional mining methods. To date reports have been received from 25 operations and indicate that improved ventilation conditions are obtained by better application of line brattice, by use of auxiliary fans—both blowing and exhausting—or a combination of both fans and brattice.

In regard to auxiliary ventilation, the use of tubing seems to divide itself into two groups. One is for removal of methane only, where dust is not a problem, and a blowing system is used with 12 to 18-in diameter ordinary fabric tubing and with fans to produce from 1500 to 10,000 cfm depending on the amount of gas liberated. The second group is where dust as well as gas is desired to be removed, and an exhaust system is called for. Again the amount of methane is the controlling factor, but because it is necessary to use a reinforced type of tubing, the pressure required is greater due to the increased friction of the tubing. Tubing size varies from 14 to 24 in. in most cases. Increased fan pressures and volumes can be obtained by using small blowers in parallel or series as the problem requires.

It is usually found necessary to also use a small blower fan mounted on the continuous mining machine to blast the face with a high velocity stream of air to disperse and dilute the gas inby the cutting head of the machine when it is operating.

Most of the reports show that brattice cloth is used during idle periods when the mine is not working to prevent harmful accumulations of gas when the power is cut off local sections. Auxiliary fans are not started until all places have been inspected.

Another associate problem is that of dust removal or collection which

Intense interest was displayed in the informative reports presented by the Coal Division Committees

is only briefly mentioned in several reports. It is agreed however that removal of dust from the working area is highly desirable because of the increased visibility that is obtained.

* * *

Charles T. Holland, in discussing "Pillar Extraction", stressed the need for a more thorough understanding of the crushing strength of coal. He briefly reviewed the results of various tests of coal by uniaxial compression that have been going on for at least 60–70 years and by a great many people. He then explained the results of current tests being done by one university that may throw new light on computing the strength of coal pillars.

* * *

The report of the subcommittee on "Cost Control" was presented by Myron Kok. By means of examples and illustrations he pointed out that an adequate and complete cost control system should:

1. Give the operator a daily profit and loss statement by each coal producing section.
2. Evaluate all types of delay—mechanical, electrical, cable, hydraulic.
3. Evaluate the most efficient work cycle to use for a given set of equipment and mine conditions.
4. Evaluate changes in projection and their effect on sectional costs and total mine costs.
5. Assist in making proper selection of new mine equipment.
6. Allow accurate forecasting of costs.

Kok concluded that costs can be reduced by changing methods and equipment but a good cost control system provides the final polish to obtain the ultimate in cost reduction.

* * *

The final report of the Committee on Mechanical Mining had to do with "Personnel Management." John E. Osmanski made the presentation. The purpose of this subcommittee is to establish the validity of aptitude and achievement tests which might be used in the coal industry, and to determine standards to measure tests against. The group is focusing its attention right now on repairmen. The mechanic's job has been analyzed into its components and, recognizing that many coal companies are now using a particular test. the subcommittee has coordinated the results of this particular one test. A method is now being devised to measure the success of currently employed and working mechanics in terms of breakdown, time, in terms of ratings by supervisors, in terms of some objective criterion. Then the subcommittee will correlate statistically the scores on a given test with this criterion of performance and if the test separates the "men from the boys" as does the criterion of performance, that the test can be said to be worthwhile.

The subcommittee's ultimate objective is to have an industry-wide battery of tests that will, for any company, under any conditions, select or predict the performance of any individual in a particular job.

* * *

COMMITTEE ON MINE SAFETY

RALPH E. KIRK, Chairman

A. C. Lordi spoke on "Safety Aspects of A-C Power." He told how a three-phase a-c power system inherently lends itself to better control of shock and ignition hazards than does a d-c system. In an a-c system, with the use of a resistance grounded neutral, protection against shock and ignition hazards can be had because of the ability to limit ground fault currents to a low value. Voltage is easily transformed so that mining machine motor control voltages, headlight voltages and auxiliary voltages can easily be made available at lower voltage. A-c arcs are inherently easier to interrupt so that control life is increased and maintenance decreased, promoting greater safety. A-c squirrel cage induction motors do not spark in normal operation, and will stall when overloaded; whereas d-c machines have a commutator and when severely overloaded, may flash over.

All of these features of a-c power promote greater safety. However, it is extremely important that maintenance be stressed to continuously realize the benefits from the safety features, both inherent and by design, in the power system—be it a-c or d-c.

* * *

COMMITTEE ON COAL PREPARATION

J. J. REILLY, Chairman

THE first group of the Committee on Coal Preparation to report was the subcommittee on "Preparation Plant Start-up Problems." R. L. Llewellyn made the presentation. Both manufacturers and coal companies have cooperated by submitting a list of common start-up problems that each has experienced. The subcommittee has correlated these to spotlight those problems which are most common.

Wm. C. McCulloch reported on "Will Cyclones Replace Drag Tanks." The place of drag tanks and cyclones in the flowsheet of a modern coal preparation plant has been under study and McCulloch briefly reviewed the capabilities of each.

Final report of the day was given by E. R. Palowitch on "Coal Preparation Equipment Efficiency." He explained that a study is under way by the U. S. Bureau of Mines to establish measures of washing efficiency that are essentially independent of the preparation characteristics of raw coal. The performance of characteristics of coal washing equipment—that is, the sharpness with which coal and rejects are separated—is a subject of paramount importance to coal preparation plant designers, coal operators and manufacturers of coal preparation equipment. Several factors tend to focus attention on the effectiveness of coal cleaning equipment to a greater degree than formerly desired. For example, coal preparation plants are expensive to build and operate and must of necessity be properly designed to perform the desired function at the optimum efficiency. Second, for economic reasons it is imperative that the maximum yield of coal of the desired quality be recovered as a salable product and avoidable losses to the reject be minimized. Third, the increasing difficult nature of the coal to be washed has necessitated in many cases washing at very low specific gravity, three-product separations, handling high percentage of impurities to the washer and many other factors which have resulted in complex and unique washing circuits.

From a practical viewpoint, there are two main aspects to be considered: (1) the establishment of improved standards of cleaning efficiency that will enable coal operators to assess their day-to-day performance, and (2) the more scientific selection of coal washing equipment in relation to the raw coal feed that must be washed and the desired product that must be obtained. The establishment of a performance criteria should materially aid in the proper selection of equipment for a particular cleaning problem and should improve the day-to-day performance of the operating plant.

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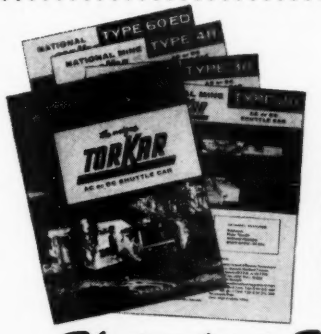
of materials handled

National Mine

TORKARS

SINGLE PRIME MOVER-TORQUE CONVERTER

Dramatic records for performance and low maintenance are being achieved wherever TorKars are used. TorKars are unique in that they are powered by a single, large capacity motor (or diesel engine) in place of small multi-motors required on conventional shuttle cars. With a torque converter and three-speed forward-and-reverse transmission applying power equally to all four wheels, flexibility of operation is vastly increased, the control system is simplified, service costs are lowered, and high operational standards are maintained.



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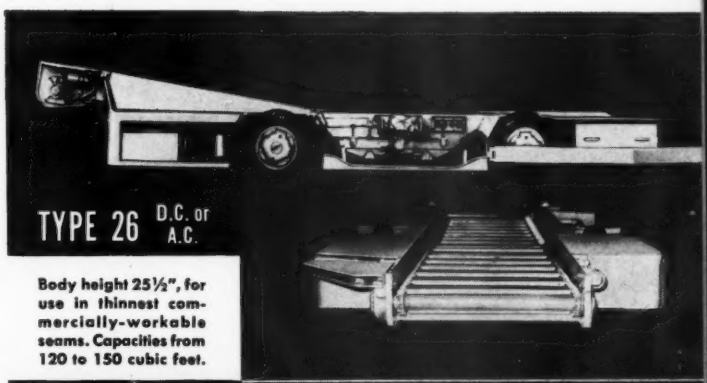
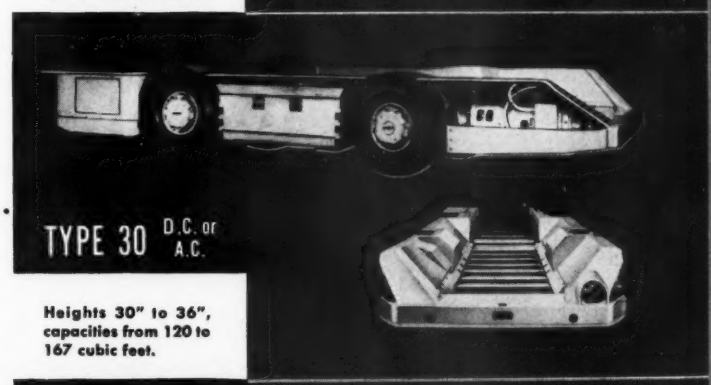
The trend is to TorKar



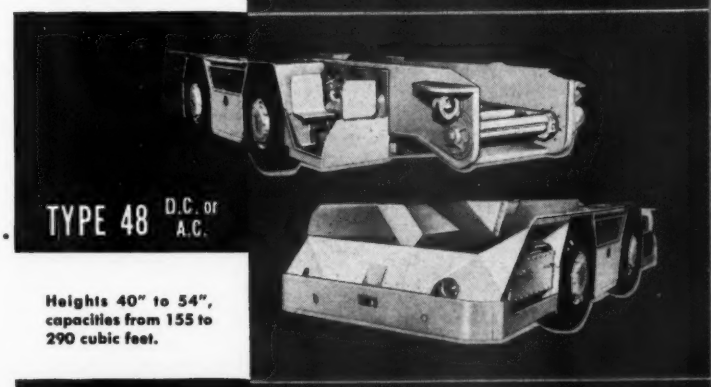
TYPE 26 D.C. or A.C.

Body height 25½", for use in thinnest commercially-workable seams. Capacities from 120 to 150 cubic feet.



TYPE 30 D.C. or A.C.

Heights 30" to 36", capacities from 120 to 167 cubic feet.



TYPE 48 D.C. or A.C.

Heights 40" to 54", capacities from 155 to 290 cubic feet.

TYPE 60 DIESEL

Height 60". Capacity 295 cubic feet or 20 tons. Equipped with patented National Mine Exhaust Gas Conditioner.

National Mine Service Company

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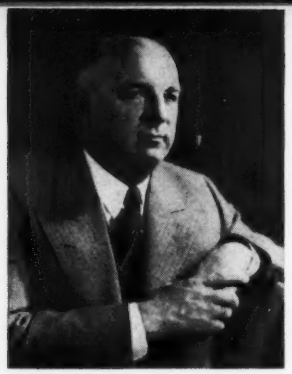


A. H. Truax ". . . Wee-Ma-Tuk will make a more pleasant life for a lot of people . . ."

There's fun for the family group as well as for the par shooter on Wee-Ma-Tuk's challenging nine-hole golf course

Spoil Banks of Exhausted Strip Mine Transformed Into Happy Hunting Grounds at

WEE-MA-TUK

IT is a lucky sportsman, indeed, who finds the pleasures of golf, fishing, boating, swimming and tennis conveniently available within the confines of one 3200-acre tract. Such a recreational package, however, has emerged from the pits and spoil banks of an exhausted strip mine in central Illinois.

Christened Wee-Ma-Tuk, an Indian phrase meaning "many lakes in the hills," the new playground was once just a hodge-podge of gray earth and deep, spring-fed lakes, owned by Truax-Traer Coal Co., whose huge shovels had moved on to richer diggings.

But a short span of time—five years in fact—has wrought almost incredible changes.

Last year some 7800 nine-hole rounds of golf were played on Wee-Ma-Tuk's 3300-yd course. It is soon to be expanded to the standard 18 hole dimensions.

Hunters, Fishermen Busy

Countless fishermen have pulled countless bass, crappies, bluegills and channel cat from more than 100 lakes which dot the area. And hunters, under controlled shooting conditions, picked off 4000 ducks and 1500 pheasants during the October 15—March 15 season of 1958–1959.

Thus it is that this year a different species of hunter, the home site seeker, roams Wee-Ma-Tuk as the word spreads that its incorporators are selling building lots on the bigger lakes.

Using Caterpillar earthmoving machinery, Wee-Ma-Tuk's developers have levelled the spoil banks to make building sites and are now offering nearly 800 lots—many of them with lake frontage—to the people who find the area's facilities ideal for their living tastes.

Development of Wee-Ma-Tuk is the story of a dream realized for the incorporators, A. H. Truax, his son Glenn, and Gene Long. All of them have been active in the strip mining business of Truax-Traer and have actively supported a fish and game conservation program of stocking the exhausted pits with fish, which the coal company has practiced in the Fulton County area since 1935.

The area around Fiat has enjoyed increasing popularity as a fishing spot during the last two decades and it was from this growing traffic at the fishing holes that the idea for Wee-Ma-Tuk developed. It occurred to Messrs. Truax and Long that there might be many a frustrated central Illinois angler who would live near

The lakes are full of lunkers for the bass fisherman, but there are plenty of "punkin seed" sunfish for the kids, too

Courtesy of "QUALITY"—
A Caterpillar Publication

Crawler tractors knocked the tops off the spoil piles to make level building sites for Wee-Ma-Tuk's burgeoning community

the lakes given an opportunity.

It took only planning and purchase of the property from the coal company to establish the present broad program of recreation and housing development which calls for the use of all of the 3200 acre area for the benefit of residents of Wee-Ma-Tuk.

Big Lake Attracts Many

Lake Wee-Ma-Tuk is the greatest single attraction. Fifty ft deep in some places, it has a shoreline of eight miles and covers about 300 acres. Sailing, water skiing, and fishing make its wooded shores desirable for cottage sites.

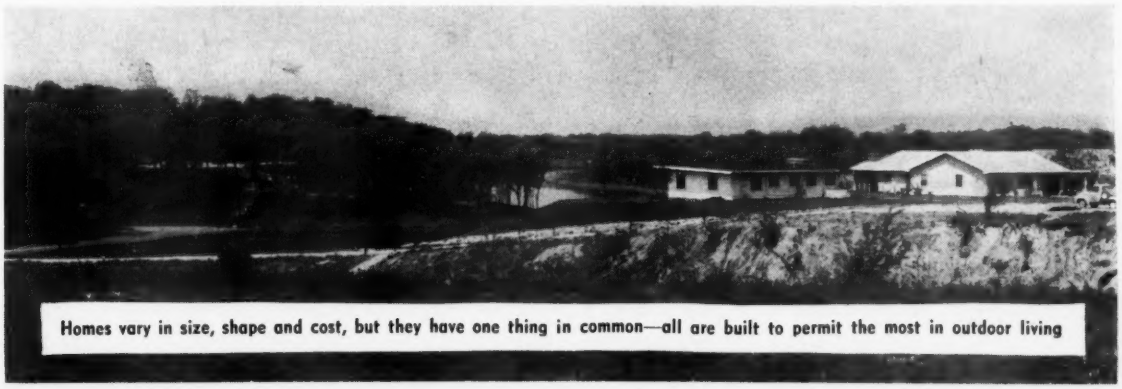
At one end of the lake and adjacent also to the golf course is the club house—a comfortable structure generously equipped to provide refreshment and nourishment to members of Wee-Ma-Tuk Hills Country Club. A two-year club membership goes with the purchase of each home site. The club faces the swimming lake—a remarkable accommodation in itself since it is "rebottomed and rebeached" each year by tons of sand hauled in for the explicit purpose of pleasing the swimmers.

There are other smaller lakes. They are popular among those who don't care for strenuous water sports, but like to fish. There are, incidentally, some real lunkers among the Wee-Ma-Tuk bass population since Truax-Traer began stocking the lakes in 1935. Six pounders are not uncommon.

Among the 15 employes who run Wee-Ma-Tuk there are two men who devote all their time to conservation work—keeping the lakes stocked and providing nesting facilities for ducks, pheasants and quail.

It seems inevitable that Wee-Ma-Tuk will become a rallying place for the outdoor sportsmen and women of central Illinois. But perhaps it has a deeper meaning. At least it does for A. H. Truax, who has retired from the board of chairmanship of Truax-Traer to his farm near Wee-Ma-Tuk in order to help promote development of the area. He has this to say about it: "In a lifetime as a coal miner I don't remember a business experience that has afforded me as much pleasure as developing Wee-Ma-Tuk. We are turning what was once a liability into something that will make a more pleasant life for a lot of people and their kids."

Winter time photo of swimming lake and club house shows how earthmovers knocked tops off spoil banks to level them for building sites. Several homes (upper left) are completed and occupied



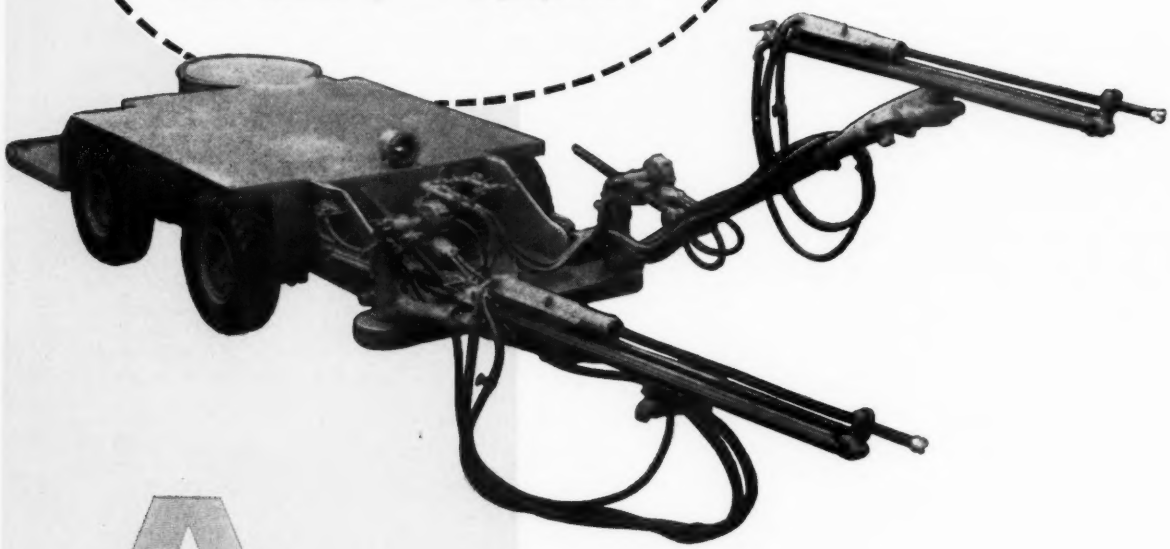
Homes vary in size, shape and cost, but they have one thing in common—all are built to permit the most in outdoor living

ANOTHER **ACME** DOLLAR SAVER

the ***NEW***

JUMBO DRIFTER

that keeps pace with
the rest of your equipment



ACME MACHINERY COMPANY

This new ACME Jumbo Drifter is a self-propelled drifter type rig for drilling rock headings or brushing top with greater speed, less effort and at lower cost.

It is equipped with four-wheel tractor type drive — either electric or air motor. Available with manual or power arm movement. Power-screw type feed or chain feed is optional, in varying lengths with 3″ or 3½″ bore drifters. Boom centers are rigged to your specific conditions. Height and grade requirements can be maintained with advance of section.

Acme builds a drill rig to suit YOUR mining conditions.

ACME MACHINERY COMPANY

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• REPRESENTATIVES IN PRINCIPAL MINING AREAS

As Viewed by HENRY I. DWORSHAK of the American Mining Congress

WHEN the 86th Congress begins its Second Session January 6, it will be under tremendous pressure to solve the problem of economy-crippling strikes if the steel strike is not settled before the termination of the current Taft-Hartley injunction January 26.

Even if the steel strike is settled, there are a number of areas in which strikes might tie up the economy or the defense program. These include, in addition to the pending railroad crisis, a possible strike against missile manufacturers and serious controversies in the electrical industry.

It seems clear that the problem arises out of union monopoly power —the fact that unions, regardless of size, are not subject to the antitrust laws. The big national unions are commanded by men with power exceeding anything ever known before outside of Government itself, and sooner or later Congress must place curbs on private authority of this magnitude.

Despite the obvious need for remedial legislation, there is widespread belief in Washington that Congress—having just passed the Landrum-Griffin labor-reform law over union opposition—is not likely to immediately enact a second union-opposed measure, particularly in a Presidential election year.

AMC PROTESTS GOVERNMENT TAX PROPOSAL

A few weeks ago it became known that the Internal Revenue Service had tentatively decided to reverse its long-standing interpretation of the law, and hold that percentage depletion for uranium must be computed on the value of crude ore rather than concentrates. The American Mining Congress immediately requested a conference with Treasury Department and Revenue Service officials, and considerable interest in the matter was expressed by members of Congress.

On November 20 AMC Tax Committee Chairman Lincoln Arnold, members of the AMC staff, and 35 tax men from the mining industry met with Treasury and Revenue Service officials. The Mining Congress pointed out that "concentrating" should be allowed whether or not a market exists prior to concentrating, and that any reversal of this long-standing interpretation of the law would seriously disrupt the uranium industry as well as have possible application to many other minerals.

The Mining Congress position was documented by a lengthy memorandum, and supported by oral argument which lasted over two hours. The Treasury and Revenue Service officials did not indicate their position at the end of the conference—it is customary in matters of this kind for the Government to study the matter at length before making its conclusions known. The results will be awaited with a great deal of interest, because the principles involved here are important to the entire mining industry.

MINERS' ACCESS RIGHTS ARE CONFIRMED BY RULING

Miners whose properties are surrounded by public lands administered by the Bureau of Land Management have the right to free access to their claims, according to a recent ruling of the Solicitor of the Interior Department.

The ruling was issued by the Solicitor, chief legal officer of the Department, after representatives of an Oregon mining claimant protested an attempt by the Oregon State office of BLM to levy a charge for the use of a road across Government land to the mining property involved. The road had been privately constructed in the 1890's and privately maintained since that time.

"Executive action along the line proposed could be used to completely destroy the rights granted by Congress under the mining laws," the Solicitor wrote. "The grant of the minerals with all incidents thereunto pertaining is direct from Congress to the miner. The Act contains no language that could be construed to authorize a Federal agency to make a charge in such a case."

As to public lands within national

Washington Highlights

TAXATION: AMC opposes Government depletion proposal

PUBLIC LANDS: Miners' access rights confirmed by ruling

LEAD-ZINC QUOTAS: Six companies seek rescission

NATURAL GAS: Importation from Canada permitted

URANIUM: U. S. to slow Canadian purchases

IMPORTS: Hearing held on zinc sheets

STOCKPILE: Procurement limited to three items

forests, the ruling pointed out, an 1897 Act of Congress expressly reserved the right of ingress and egress for "all proper and lawful purposes including that of prospecting, locating and developing the mineral resources thereof," subject to compliance with pertinent rules and regulations. The Department of Agriculture, in its regulations governing national forests, "does not even require the constructor of a road in such cases, to obtain a permit."

SMELTERS ASK REVIEW OF LEAD-ZINC QUOTAS

Six U. S. companies which own about one-half of the Nation's lead-zinc smelting and refining capacity have petitioned the Tariff Commission for a review of the effects of the current lead-zinc import quotas on the domestic producing industry. The petition asks the Commission to recommend to the President that the quotas be rescinded promptly and that reasonable increases in import duties on the two metals be substituted.

Prompt action is required, according to the petition, because of changes in competitive conditions affecting trade in lead and zinc.

Present quotas, in addition to limiting metal imports, limit imports of ores and concentrates, upon which the petitioning companies depend for all or part of their raw materials. The petition suggested that a "reasonable increase" in present import duties on the two metals would be a better solution to the problem of excessive imports.

These companies signed the petition: American Smelting & Refining Co., New York; American Zinc, Lead & Smelting Co., St. Louis, Mo.; Athletic Mining & Smelting Co., Fort Smith, Ark.; Blackwell Zinc Co., Inc., New York; Matthiessen & Hegeler Zinc Co., LaSalle, Ill., and National Zinc Co., New York.

NATURAL GAS IMPORTATION APPROVED BY GOVERNMENT

The Federal Power Commission has contingently approved a $52.3 million pipeline project proposed by Midwestern Gas Transmission Co. to import 204 million cubic feet of natural gas—approximate equivalent of 8500 tons of coal—daily from Canadian fields into the north central United States. The company plans to build a 504-mile pipeline to transport the gas from Emerson, Manitoba, and to sell most of it to another pipeline company at a connecting point in Wisconsin.

Conditions imposed on Midwestern's authorization require the obtaining of necessary Canadian authorizations for export of the gas and the filing with the Commission of satisfactory rates and firm proposals for financing.

U. S. WILL SLOW PURCHASES OF CANADIAN URANIUM

The U. S. Atomic Energy Commission announced last month that it will not purchase any Canadian uranium concentrates beyond the amounts already under contract—a decision long urged by mining industry spokesmen.

Purpose of the decision, AEC indicated, is to avoid building up a uranium surplus and to reduce annual procurement expenditures.

Under existing U. S. contracts to buy Canadian uranium, the last of which expires in March 1963, about 40,000 tons of uranium oxide worth approximately $1 billion are to be delivered. Domestic uranium miners had been fearful that the AEC would make further commitments for Canadian concentrates and thus reduce the potential market for their own production.

AEC also announced that it had reached agreement with Canadian Government officials to defer part of its purchase commitments beyond contract expiration dates. This action was taken to ease the impact of the AEC decision on the Canadian uranium industry, which had urged the U. S. Government to exercise contract options calling for additional purchases during 1962–1966.

TARIFF HEARING HELD ON ZINC SHEET IMPORTS

As part of an escape-clause investigation requested in July by three domestic zinc companies, the Tariff Commission held public hearings last month to help it determine whether imports of zinc sheets are causing or threatening serious injury to the domestic industry producing various types of zinc sheets.

A spokesman for one of the petitioning companies said imports of sheets which accounted for only 1 percent of domestic production in 1952 rose to 21 percent by 1958. He asked the Commission to recommend that the President increase the duty on zinc sheets to 46.9 percent of their value based on sales price in the country of origin. The recommended duty is the maximum level permissible under the Trade Agreements Extension Act of 1958. The witness pointed out the favorable labor cost differential enjoyed by foreign competition, and concluded that "because of this tremendous disparity, we must have increased import protection if we are to survive."

C. E. Schwab, who spoke for the Emergency Lead-Zinc Committee—an organization representing domestic lead-zinc mining companies—testified in support of the need for greater protection against imports of zinc sheets. Schwab, a former chairman of the ELZ Committee, said that imports of zinc sheets, or any other "manufactured" zinc articles, "will serve to dilute the available market in the United States for zinc produced from U. S. mines. It is axiomatic that should this flow of imports reach substantial levels and continue to increase, the U. S. miner steadily loses a larger and larger portion of his consumer market."

Schwab discussed potential circumvention of present import quotas on zinc metal, concentrates, and ores, declaring that "it has been the consistent position of the domestic lead-zinc mining industry that if import controls exist for 'unmanufactured' zinc some compensatory controls must also exist for 'manufactured' zinc. Otherwise it has seemed to us that the stated intent for import controls on 'unmanufactured' zinc . . . might well be frustrated and the anticipated results substantially diluted."

The Tariff Commission must submit its recommendations to the President not later than January 14.

STOCKPILE PURCHASES LIMITED TO THREE ITEMS

Government purchases for the strategic stockpile will be limited to only three items—chrysotile asbestos, jewel bearings, and small diamond dies—during the remainder of the current fiscal year ending next June 30, the Office of Civil and Defense Mobilization has disclosed.

Upgrading of a small amount of stockpiled tungsten and molybdenum to tungsten-carbide powder and molybdic oxide is also planned by the agency. OCDM officials estimated that the upgrading may cost about $2.7 million, and that approximately $6.5 million would be available for the purchase program.

Small size of the procurement program, according to OCDM Director Hoegh, reflects the fact that basic objectives have been reached for almost all of the strategic materials in the stockpile. The program may be revised, however, after the agency completes a current study of prospective needs for rehabilitation of the country following a nuclear attack.

personals

Thomas G. Ferguson has been elected president and chief executive officer of National Potash Co. Ferguson joined National as vice president and general manager when the company was formed in 1955 and was in charge of the development and operation of the company's mine near Carlsbad, N. Mex. He had previously been vice president of Pittsburgh Coal Co., division of Consolidation Coal Co.

Herbert E. Steinmann, Jr., has been appointed chief mining engineer, Vesta-Shannopin Coal Div., Jones & Laughlin Steel Corp. Steinmann, who was assistant chief mine engineer, succeeds the late **N. A. Borzella.**

L. Worthington

Leslie B. Worthington has been promoted to president of United States Steel Co. succeeding the late **Walter F. Munford.** Worthington also was elected a director, chairman of the executive committee and chairman of the operations policy committee. He was first employed by U. S. Steel as a sales apprentice in 1923 and has since served in numerous managerial and executive capacities. For the past two years he has been president of U. S. Steel's Columbia-Geneva Division.

M. A. Sofo has been appointed fuel engineer by Island Creek Coal Sales Co. Sofo became associated with Island Creek in 1955 when it acquired Red Jacket Coal Corp.

Hugo Reimer, executive vice president of U. S. Borax & Chemical Corp., has been elected chairman of the board of U. S. Borax Research Corp. **Dr. D. S. Taylor** has succeeded Reimer as president of the subsidiary research company.

N. R. Crump, president of Canadian Pacific Railway Co., has been elected a director of the International Nickel Co. Crump, in addition to being a member of the Canadian Pacific board, is a director of Consolidated Mining & Smelting Co. of Canada.

Charles R. Hook, chairman of the board of Armco Steel Co., has resigned the position due to ill health, but will continue as a director. Hook joined Armco in 1902 and became president of the company in 1930. He was elected chairman of the board in 1948.

M. D. Ayers, assistant to the president of Kennecott Copper Corp., has been appointed director of engineering. Ayers had been chief engineer of the Wheeling Steel Corp. prior to joining Kennecott in 1956. From 1933 to 1946 he had been associated with U. S. Steel Corp., and in 1946 assumed the post of chief engineer of the Hamilton Works, Steel Company of Canada.

Wing G. Agnew, recently named head of the U. S. Bureau of Mines, Spokane, Wash., office of Mining Research, has been appointed mining engineer in the Washington, D. C. office of Secretary of the Interior, Fred A. Seaton. Agnew had been in the Spokane office since 1954 when he was made head of the Bureau's northwest mining division. Before the 1954 appointment, he was chief of the USBM underground mine laboratory and experimental station at Mount Weather, Va., for 15 years.

New officers have been elected to head the New Mexico Mining Association for 1960. **E. A. Slover,** general manager, Chino Mines Division, Kennecott Copper Corp., was elected president. Other officers are **E. H. Miller,** regional manager, U. S. Borax & Chemical Co., first vice president; **L. W. Swent,** manager, Homestake-Sapin Partners, second vice president; and **W. F. Darmitzel,** Santa Fe, re-elected executive director and secretary.

W. R. Storms, supervising mining engineer and superintendent, Southwest Experiment Station, U. S. Bureau of Mines, has retired, but will remain active as a consultant.

B. A. Robbins, assistant to the general manager, Chino Mines Division, Kennecott Copper Corp., has retired after 39 years service with the company.

Leslie R. Vance has been appointed mine maintenance superintendent, Bunker Hill Co., replacing **Gordon J. McCulloch,** who has accepted a position with another company. Vance has been employed as a design engineer with Bunker Hill since 1955. Previously, he had been with Day Mines.

Horace Y. Bassett, president of Calumet & Hecla Inc., has been elected a director and board chairman of Flexonics Corp. **Albert E. Petermann,** Calumet & Hecla vice president, was also elected a director of Flexonics.

Stuart T. Saunders was recently elected board chairman of American Coal Shipping, Inc. and A. H. Bull Steamship Co. He is president of the Norfolk & Western Railway. American Coal Shipping is a partnership of coal mining companies, railroads and the United Mine Workers of America engaged in the export coal business.

Richard Maclin Stewart has been appointed director of mining research of Anaconda Co. succeeding **Edward R. Borcherdt,** who recently retired to become a partner in a consulting firm, Borcherdt & Smith. Stewart joined Anaconda in 1948 as a miner. In 1950 he was assigned to the mining research department and had risen through various departmental posts to be designated assistant research director last February.

R. Stewart

JOINS AMC STAFF

Richard A. Squires, former assistant to Assistant Secretary Roger Ernst of the Department of Interior, has joined the staff of the American Mining Congress. While with the Department, Squires represented Secretary Ernst in legislative and administrative matters dealing with public lands.

Squires, a former Salt Lake City newspaperman, came to Washington in January 1953, as administrative assistant to Representative William A. Dawson of Utah, a position he held for six years. As assistant to Rep. Dawson, who was a member of the House Interior and Insular Affairs Committee, his work included legislative research, public relations and preparation of testimony dealing with many phases of mining and public lands legislation.

A native of Salt Lake City, the new Mining Congress staff member attended the University of Utah and took graduate work at the University of California. He began his newspaper career with the *Berkeley* (Calif.) *Gazette*, later transferring to the *Salt Lake Tribune* where he became legislative and statehouse reporter. He also served for a period as editor of *Intermountain Industry*, a regional publication for the mining, construction and transportation industry.

Ira K. Hearn, assistant general manager, Utah Copper Div., Kennecott Copper Corp., has resigned to accept the position of vice president in charge of operations, Celotex Corp. Hearn joined the Kennecott organization in 1949 after 12 years with Tennessee Coal and Iron Div., United States Steel.

Albert L. Fairley, Jr., president, Dominion Steel & Coal Corp., Ltd., has been elected to the board of directors of A. V. Roe Canada, Ltd.

Lawrence S. Pricher has been elected a vice president of New Jersey Zinc Co. Pricher formerly was vice president-finance of Foster-Wheeler Corp.

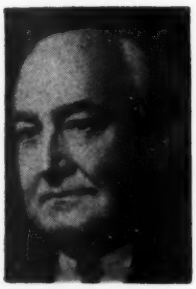
Charles E. Newmeyer, editor of the Denver published Mining Record since 1917, has retired after 49 years of service with the newspaper.

Bernard J. O'Neill, Jr., formerly resident geologist in charge of exploration for Pennsylvania and the middle Atlantic states, New Jersey Zinc Co., recently accepted a position as geologist in the Department of Earth Sciences, Stanford Research Institute.

J. W. Faust, general manager of Peru Mining Co., was recently elected a vice president of Hydrometals, Inc. Faust joined Peru, a Hydrometals subsidiary, in 1937 after working as a mining engineer in New Mexico and Texas.

David P. Griffith was recently named vice president-operations of the Hercules Cement Co., division of American Cement Corp. Griffith joined Hercules in 1950 as plant superintendent of the company's Stockerton, Pa. plant. In 1951 he was named plant manager. He will continue to be responsible for Hercules' operations, including engineering.

OBITUARIES



Louis Shattuck Cates, 77, chairman of Phelps Dodge Corp., died on October 29 in New York City.

Mr. Cates, a great and highly respected copper industry executive, was a graduate mining engineer. His career began at Bingham Canyon, Utah, where he was employed as a timekeeper by the Boston Consolidated Mining Co. in 1903. Rising rapidly he had become general manager by 1910. After Boston Consolidated was absorbed by Utah Copper Co. he was sent to Arizona by the late Daniel C. Jackling to reorganize the operating staff of the Ray (Ariz.) Consolidated mine and became general manager of that operation in 1913. Recalled to Utah Copper in 1919, he advanced to vice president and managing director in 1923. He resigned from Utah Copper in 1930 to succeed Walter Douglas as president of Phelps Dodge Corp. and in 1947 was elected chairman of the board.

In addition to other professional affiliations, he had been president of the American Mining Congress in 1925 and the American Institute of Mining & Metallurgical Engineers in 1946.

John Carver Richards, 76, well known Mesabi iron range mining engineer, died in Virginia, Minn., October 15. Mr. Richards had been active as a consulting engineer and representative of certain fee interests owning iron ore land on the range. He had served one term in the Minnesota legislature and was held in high esteem for his State-wide activity in matters of community interest on the Mesabi range.

Albert F. Miller, 55, manager for the Cleveland district of North American Coal Co., died in Cleveland, Ohio, October 16. Mr. Miller had been with the company 23 years.

Guy Yeager, 54, chief, engineering department, Tralee mine of Semet-Solvay Co., died in Mullens, W. Va., November 9.

Dan Parmelee Eells, 75, a retired vice president of Bucyrus-Erie Co. died at Milwaukee, Wis., October 14.

Mr. Eells joined Bucyrus-Erie in 1907, and during 38 years of service with the company had established a world-wide market for its excavating equipment. At the time of his retirement in 1945 he was a vice president and director of the company, which was founded by his father in 1880.

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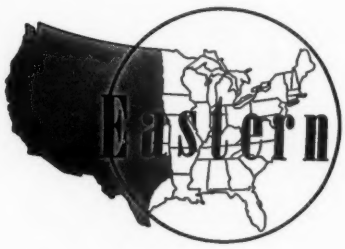
NEWS and views



Bureau Tests Feasibility of Using Water Jets to Mine Coal

The U. S. Bureau of Mines has begun experiments in mining American bituminous coal by using powerful jets of water. Site of the research is an old mine of Rochester & Pittsburgh Coal Co., near Indiana, Pa. Here Bureau engineers employ a jet of water, at pressures up to 4000 psi, against the coal face to break down the coal. The system resembles that used for many years in the hydraulic mining of gold in certain parts of the West.

An immediate advantage in the hydraulic mining of coal, according to the Bureau, is the elimination of explosive coal dust. This safety measure might be coupled with increased output under certain conditions, an essential element if commercial acceptance were to result.

The Pennsylvania tests, which will continue for several months, will include studies of types of nozzles, pumping equipment, and water lines, the effects of varying the water pressure, and finally the possibility of using water to convey the broken coal from the mine or to underground loading points.

St. Lawrence Builds Columbium Pilot Mill

With a successfully tested new concentrating process, the financial backing of a New York investment house, and willingness of U. S. interests to build a multi-million dollar columbium refinery in the United States, St. Lawrence River Mines is hoping to become Canada's first columbium producer.

The first step was recently taken with the award of contracts for a pilot plant in Montreal, which will not only pave the ground for a full size mill, but will also provide concentrates for further testing of refining methods and to investigate uses in high-temperature resistant alloys.

Plans call for open pit mining of the company's deposits in the Oka area, 35 miles from Montreal. Total holdings of St. Lawrence River Mines, its associated companies and the parent Gourd-Riverin Syndicate in the Oka area comprise 5470 acres.

In anticipation of bringing its columbium properties into production St. Lawrence River Mines is also conducting an extensive market research and development program.

Southern Coal Producers Meet

A steadily increasing demand for bituminous coal, particularly for public utility power production and the manufacture of steel, was predicted by speakers at the 18th Annual Meeting of the Southern Coal Producers Association at Roanoke, Va., November 9–10. More than 300 SCPA members and guests present also were told that Europe's rapidly expanding economy gives promise for a good U. S. coal export market over the years, despite the surplus stocks on hand in European coal and increased threat of oil and gas competition.

Officers reelected by the Association included Joseph E. Moody, president; John F. Lane, secretary, and L. E. Tierney, Jr., treasurer.

First Gypsum from Sperry Mine

The first gypsum was recently removed from U. S. Gypsum Company's new mine at Sperry, Iowa. The 600-ft operation is one of the deepest gypsum mines in the country, second only to the company's 775-ft deep operation at Plasterco, Va.

Although regular mining operations are not scheduled to begin until early spring 1960, approximately 15,000 tons of gypsum will be removed through the ventilating shaft as miners develop the drifts connecting with the main shaft 300 ft to the north. This rock will be stockpiled to provide an initial supply of gypsum for the plant when it opens early next year.

Oglebay Norton Acquires 11 West Virginia Mines

In order to supplement its coal reserves and operations, Oglebay Norton Co. of Cleveland has purchased the West Virginia property of Truax-Traer Coal Co. of Chicago. The new properties are comprised of eight drift mines and three auger strip mines that produce coal from five West Virginia seams. These additions to the present four Oglebay Norton deep mines in West Virginia and Ohio double the company's coal producing capacity to a total of 5,000,000 tons annually.

Also acquired are two coal preparation plants, one of which provides for both rail and river barge shipments. The Ceredo central preparation plant, located on the south bank of the Ohio River near Huntington, W. Va., handles coal from the West Virginia mines with a rated capacity of 750 tph. The Shamrock preparation plant at Kayford, W. Va., with cleaning facilities for metallurgical and steam coal, has a rated capacity of 400 tph. Ceredo and Shamrock bring the total number of Oglebay Norton preparation plants to six.

Inland Joins Group to Mine Canadian Ore

Inland Steel Co. recently announced that it has become associated with a group of U. S. and Canadian iron mining and steel companies that is investigating the development of a large body of iron ore in the Wabush Lake area of Labrador. The company

has acquired a ten percent interest in Wabush Iron Co., Ltd., which has a long term lease on a five mile square tract near the western border of Labrador, 200 miles north of Seven Islands. Other owners of Wabush Iron are Youngstown Sheet & Tube Co., Steel Co. of Canada, Ltd., Interlake Iron Corp., and Pickands Mather & Co.

Midget Flash Unit Developed by Bureau of Mines

Development of a permissible midget photoflash unit for safe use in coal-mine photography was recently disclosed by the U. S. Bureau of Mines. Tested under exacting safety conditions in Bureau laboratories, the 4.7-lb midget unit proved it would not ignite explosive atmospheres when fired. More details can be obtained by writing the Branch of Electrical-Mechanical Testing, Bureau of Mines, 4800 Forbes Ave., Pittsburgh 13, Pa.

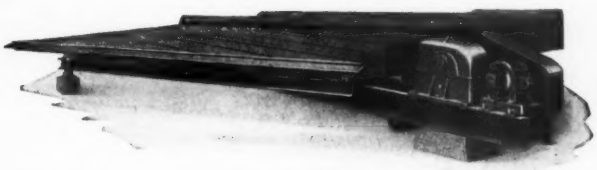
ALSO . . .

Armour Agricultural Chemical Co., a division of Armour & Co. of Chicago, has effected a major organizational realignment. The company's operation has been set up in two major divisions—the nitrogen-phosphate division and the fertilizer division. Armour's 27 fertilizer producing operations in the United States, plus one each in Puerto Rico and Cuba, will be grouped in the fertilizer division. Plants in the nitrogen-phosphate group include a phosphate mining and processing plant at Mt. Pleasant, Tenn., a newly acquired facility in Crystal City, Mo., and two in Bartow, Fla.—a phosphate mining and processing plant and a "triple superphosphate" producing plant.

Construction of a multimillion dollar 90-mile long coal-carrying pipeline between East Liverpool and Ashtabula Harbor, Ohio, is under consideration by Youngstown Coal Pipe Lines Co. The project is one of many proposed coal pipelines now being studied as a result of the successful 107-mile line built and operated by Consolidation Coal Co., between Georgetown, Ohio, and Eastlake near Cleveland. The new facility would be a 14-in. line designed to carry about 3,000,000 tons of coal annually from East Liverpool's Ohio River barge docks to Ashtabula Harbor to be dumped into Great Lakes ships to be hauled to Toledo and Detroit electric utility plants.

A 24-in. pipeline that would link the vast West Virginia coal fields with electric utilities in New York, New Jersey and Pennsylvania is also being considered. Participants in this plan would be Consolidation Coal Co. of Pittsburgh, which would supply the fuel; Texas Eastern Transmission Co., which would build and operate the line, and the utilities themselves —Consolidated Edison Co. of New York, Public Service Electric & Gas Co. of New Jersey, Pennsylvania Power & Light Co. of Allentown, Pa., and Philadelphia Electric Co.

Armco Steel Corp., Middletown, Ohio, has announced plans to double the size of its research center and push forward with the most extensive product and process research program in its history. Total cost of the building extension and new research equipment will be more than $3,500,000.



This Concentrating Table Offers Identical Economic Advantages in Any Size Mill

The size of your mill has no effect on the high economic contribution the SuperDuty® DIAGONAL-DECK® table can bring to your mineral concentration.

Used singly or in battery, each table is a compact, highly efficient unit that delivers highest grade concentrates while cutting tailings losses to a minimum and greatly reducing the volume of middlings for recirculation. This, in turn, saves wear and tear on circulating equipment and makes room for more tons of new feed per day.

For subsequent expansion at the same high efficiency, simply add tables as required. Send for full information. Ask for Bulletin 118-C.

CONCENCO® Type "CPC" Classifier

This all steel Constriction Plate Classifier is available in 1 to 10 or more cells. Novel secondary classification sharpens the separations made by each main cell. Advantages offered are: (1) accurate classification or sharp sizing, (2) easy and effective hydraulic water regulation, (3) as many spigot products as there are cells, (4) continuous discharge, (5) no moving parts, (6) low maintenance cost.

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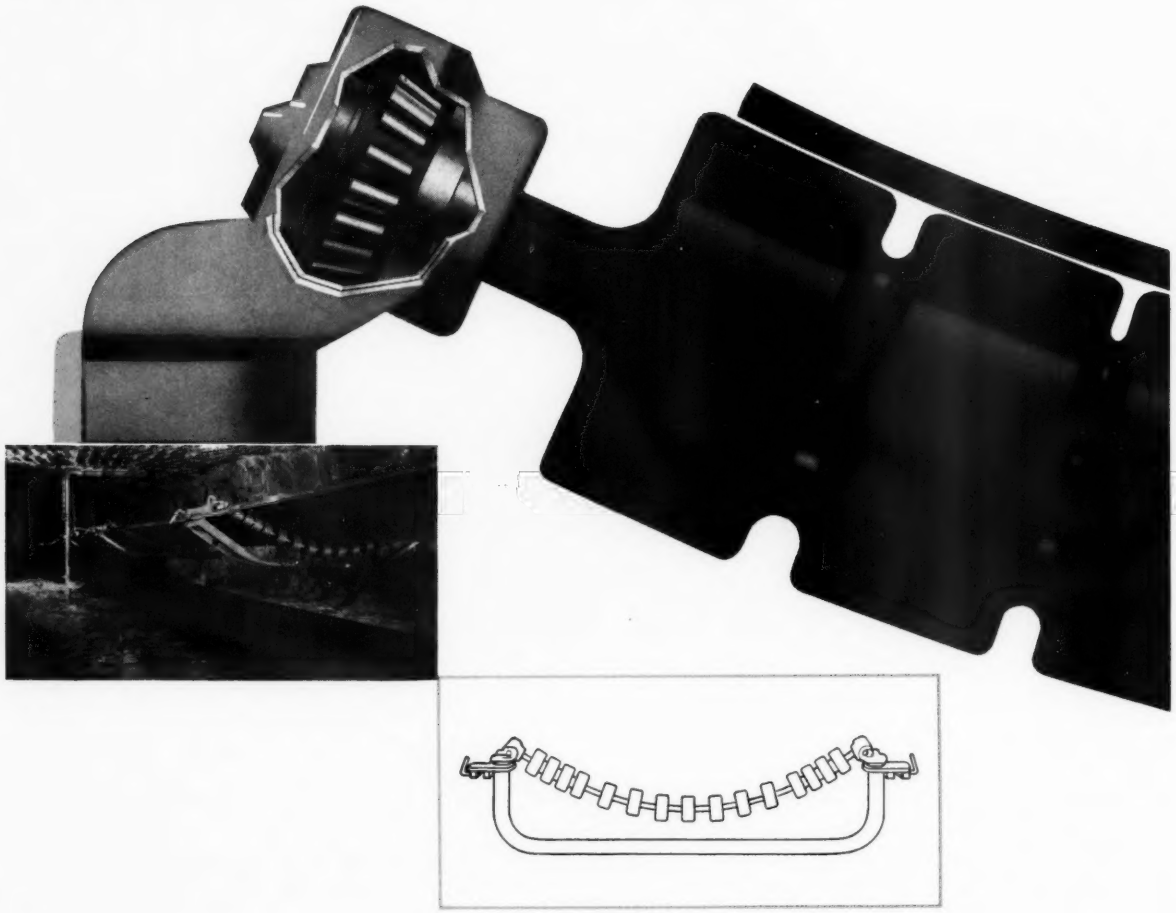
Bearing Location is the Key to Long Service Life



JOY LIMBEROLLER® CONVEYOR IDLERS

Joy Limberoller Conveyor Idlers give many times the normal service life, because the two bearings rest in slots in the support brackets—well away from spillage. On underground conveyor lines, troughing is improved and belt life is increased because the Limberoller idler, mounted on wire rope stands, "gives" with the load. Limberollers have given many times the service life of steel idlers.

Limberoller Idlers consist of a neoprene coated wire rope to which are moulded neoprene discs. The ends of the rope turn in sealed bearings. This design not only eliminates clogging and freezing of the bearings, but also makes the idlers easy to service—they can be replaced while the belt is moving.

Limberollers are economical, not only because of long service life, but also because they can be spaced further apart than steel idlers. They are corrosion and flame resistant, self-cleaning, and eliminate the "bump" typical of steel idlers.

For complete details, write for Bulletin 352-3.

WORLD'S LARGEST MANUFACTURER OF UNDERGROUND MINING MACHINERY

JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

Reactivation of the Piquette lead-zinc mine and mill, Tennyson, Wis., has been announced. When in full production, 6000 tons of zinc concentrates and 600 tons of lead concentrates will be produced annually. The property, developed jointly by Francis Piquette and American Zinc, Lead & Smelting Co., was first opened in 1955 and has been shut down since December 1957.

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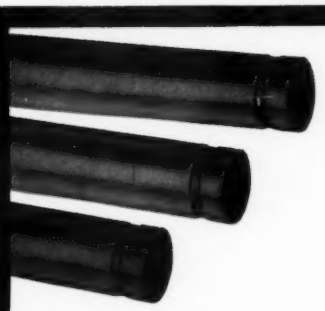
CUT COSTS WITH THE NEW
VIC-EASY®
METHOD OF JOINTING LIGHTWEIGHT PIPE

SAVE UP TO 60% IN PIPING COSTS!

Now there's no need to buy overweight pipe. Thanks to Victaulic engineering, you can select lightweight pipe "job-rated" to your conditions and install it the *new VIC-EASY way*. You'll cut costs of pipe, transportation, and handling —you'll save from 30% to 60% in man-hour installation.



1. LIGHTWEIGHT PIPE in thicknesses from .065" handles high pressures. Leading mills make sizes 1¼" to 12", steel or aluminum, with *VIC-EASY roll-grooved ends.*

2. VIC-EASY PORTABLE GROOVER rolls grooves into pipe in seconds. Manually or power-operated, this groover removes no metal...retains full wall thickness.

3. VICTAULIC SNAP-JOINT COUPLING assembles and locks by hand—no wrenches or tools required. Other bolted styles of Victaulic Couplings alternately usable.

4. VICTAULIC FULL-FLOW FITTINGS team up with our couplings and lightweight pipe to provide a *complete VIC-EASY system*...cuts costs of installation *and* operation.

For complete information write for Bulletin DD12

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Get DOUBLE EXPANSION
for
DEPENDABLE roof support
with
PATTIN
roof bolts and
expansion shells

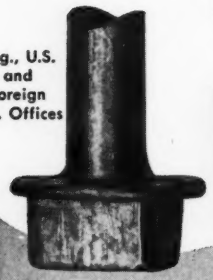
STYLE D-1

The unique double expansion feature of all Pattin expansion shells insures *dependable* roof support, in hard or soft roof conditions. Their double holding power guards against failure — even under a 20 ton pull!

Pattin features include a parallel contact with the hole, and no definite drilling depth is required, as the shell can be securely anchored at any place in the hole. They anchor solidly and will not turn while being tightened. Wedge and shell are assembled in a manner to prevent loss of parts in handling, and the bolt and shell assembly are furnished as a complete unit. Plates are bundled separately. No special nuts or ears are required on the bolts. These features make a safer roof — and a safer roof means fewer accidents, increased production, more clearance for equipment operation and better ventilation.

Pattin specializes in roof bolting —it's our business, not just a sideline! Your business is important to us, and our service engineers are always available for consultation on your roof problems—ready to give you service when you need it! WRITE OR PHONE US TODAY for complete details.

Reg., U.S. and foreign Pat. Offices



The PATTIN split-type BOLT

The split-type bolt is one of the first slotted bolts, and continues to be a favorite wherever split-type bolts are used. Many mines still prefer this type. The bolt is a full 1-inch in diameter, with cut threads and furnished with hex or square nuts and various size plates and wedges.

IN WESTERN STATES

Pattin expansion shells are available and serviced exclusively by Colorado Fuel and Iron Corporation, Denver, Colorado. Western mining companies should contact them direct for information and consultation.

PATTIN
MANUFACTURING COMPANY
MARIETTA, OHIO

The PIONEER of roof bolting . . . established 1888

American railroads will be electrified over a ten-year period with the big push coming before 1965, according to John W. Barriger, president of the Pittsburgh & Lake Erie Railroad. Speaking at a round-table session which was part of a West Virginia coal mine tour sponsored by the National Coal Policy Conference, he predicted that coal would be the major source of energy in the development of electrified railroads. Estimating the cost of railroad electrification at an average of $15,000 per mile of track, he said it would be offset by reduced operating expenses.

American Metal Climax Inc. will build a refining plant at Carteret, N. J., to produce germanium metal for the electronics industry. The plant is expected to be in full operation next year.

First production of pig iron in Quebec from Quebec iron ore pours from furnaces of Quebec Iron & Titanium Corp. at Sorel. The company—owned by Kennecott Copper Corp. and New Jersey Zinc Co.—developed a process to produce high carbon and silicon iron for Quebec foundries. It mines titaniferous iron ore 500 miles below Sorel on the St. Lawrence River.

The Millville, W. Va., quarry of Jones & Laughlin Steel Corporation's Blair Limestone Division has been awarded a Certificate of Achievement in the National Lime Association's 1958 Safety Competition. The Millville quarry, one of 14 concerns to win the award for accident-free performance during 1958, had a record of 136,409 man-hours worked without a disabling accident during 1958. Its accident-free record now extends from January 28, 1954, for a total of more than 720,000 man-hours worked safely by all employes.

Morton Salt Co., Chicago, Ill., recently opened a new rock salt mine on the south shore of Lake Erie at Fairport, Ohio. Development of the property commenced in 1955. When ultimate capacity is reached, production will be at the rate of 500 tph.

Vitro Corporation of America recently announced the formation of a subsidiary, Vitro Chemical Co., to consolidate its chemical and metallurgical operations in the United States, including those conducted by Vitro Uranium Co., Salt Lake City, Utah; Heavy Minerals Co., Chattanooga, Tenn.; and Vitro Rare Metals Co., Canonsburg, Pa. William B. Hall, who was appointed a vice president of the parent company last January and who will continue in that post, was named president of the new subsidiary.

Glidden Co. has acquired a large ilmenite ore deposit in Ocean County, N. J., from American Metal Climax, Inc. In addition to a mine, plans call for the construction of a concentrating and separating plant on the property. The plant is slated for completion in late 1961.

American Zinc Co. of Tennessee, a wholly-owned subsidiary of American Zinc, Lead & Smelting Co., has reactivated the Grasselli mine at New Market, Tenn. The property has been idle since December 1957. Annual production will be approximately 9,000 tons of 60 percent zinc concentrates.

NEWS and views

American Zinc Joins Hydrometals to Operate Peru Mining Co.

American Zinc, Lead & Smelting Co. and Hydrometals, Inc., are establishing a joint venture for the development and exploitation of mineral resources and mining and milling facilities of Peru Mining Co., Silver City, N. M. This has been a wholly-owned subsidiary of Hydrometals. Properties of Peru Mining have been fully maintained but not operated during the past three years while zinc prices were low. Concentrates to be produced by the joint venture will be converted into slab zinc at American Zinc's Dumas, Tex., smelter.

Under a second and separate long-term agreement between the two companies, the Monsanto, Ill., electrolytic plant of American Zinc will cast, on a semi-continuous basis, 8000-lb ingots of "Hydro-T-Metal," Hydrometals new alloy of titanium copper and zinc. The record-weight ingots will move from Monsanto directly to the rolling and extrusion mills of the Dow Metal Products Co. at nearby Madison, Ill., where they will be rolled into coils of sheet metal or be extruded.

Asbestos to be Mined

A 15,000,000-ton chrysotile asbestos deposit near Stockton, Calif. has been optioned from American Asbestos Co. Jefferson Lake Sulphur Co. of New Orleans recently exercised an option to acquire the property at a purchase price of $4,200,000 payable over a 12-year period. Exploration work by Jefferson Lake has proven "about 15,000,000 tons of commercial ore and substantial additional quantities are indicated." The company plans to install mining equipment and erect a 2000 tpd mill to supply the California asbestos fiber market. California, which is the second largest consumer of asbestos fiber in the United States, currently imports all its requirements from foreign sources.

Plan Phosphorous Complex

A $20,000,000 elemental phosphorus complex is planned for Utah's Unitah Basin near Vernal. Stauffer Chemical Co. contemplates developing estimated reserves of 700,00,000 tons of phosphate rock containing 20 percent P_2O_5, and constructing facilities for producing elemental phosphorous.

The proposed project is based on obtaining large quantities of power from Flaming Gorge Dam for operation ultimately of two 35,000 kw elemental furnaces. San Francisco Mining Co., jointly owned by Stauffer and Mountain Copper Co., has taken an option to purchase the deposit which covers 14,000 to 15,000 acres and is one of the largest deposits of phosphate rock in the U. S.

Plan 1,500,000 Bbl Cement Plant

A $14,000,000 cement plant, to be built in the immediate future by Flintkote Co. at Redding, Calif., is scheduled for completion in March 1961. Calaveras Cement Co., a newly acquired division of Flintkote, will direct construction of and operate the new plant, which will be situated on a 1500-acre raw material site. Initial rated annual capacity of the plant is to be 1,500,000 bbl. Proven limestone reserves at the plant site are estimated equivalent to 172 years production at the initial output rate, and shale reserves are adequate to meet this use of limestone. Water, power and fuel are available nearby, and existing transportation facilities are considered ideal to serve Northern California and Oregon markets.

Refinery to be Expanded

Work has commenced to increase copper refining capacity at Copper Refineries Pty Ltd., Townsville, Queensland, Australia, to 60,000 long tons per year. The plant, which has a 40,000 long ton per year capacity, treats blister copper from Mount Isa 600 miles west of Townsville, and was only recently officially placed in operation. The total cost of the refinery and related facilities will be about $11,200,000. Copper Refineries is a wholly owned subsidiary of Mount Isa Mines Ltd., in which American Smelting & Refining Co. has a substantial stock interest.

Power Company Leases Coal Deposits

Eastern Montana coal deposits have been leased to Montana Power Co. in an arrangement involving 3300 acres of Northern Pacific Rwy. land near Colstrip, Mont. A 30-year lease has been given to Montana Power, who will mine the coal for use at a steam-electric generating plant. Also included in the transaction is an assignment by the railroad of its lease on 1300 acres of federally owned land. The N. P. property has previously yielded 44,000,000 tons of fuel over a 30-year period for consumption in coal-burning locomotives.

ALSO . . .

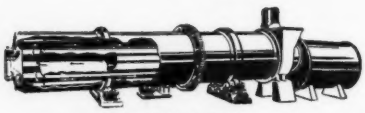
After four years of work and expenditures of $1,500,000 the joint Bunker Hill-Hecla-DMEA exploration project at Silver Mountain near Mullan, Idaho, has been halted. The project had been initiated to search for new ore deep beneath the old Snowstorm copper mine. Further work is not anticipated since the results were essentially negative.

Using nonradioactive materials, the Atomic Energy Commission is conducting experiments to study possible disposal of radioactive wastes in natural salt formations. In cooperation with the Carey Salt Co., Hutchinson, Kans., AEC will conduct experiments in an unused portion of a Carey salt mine to determine if natural salt formations can hold radioactive wastes without leakage, and whether or not they can dissipate heat that would be generated if the stored material were radioactive.

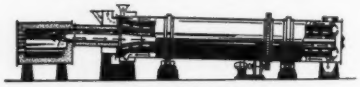
A $32,400 research grant to study the role of stress waves in breaking up rocks has been awarded to Colorado School of Mines by the National Science Foundation. The project is aimed at creating a better understanding of factors which control the breaking up of rocks, which is of interest to the mining and mineral processing industries. Studies will be made to determine behavior of rocks when struck sharp blows and their behavior under explosive pressures.

Ruggles - Coles

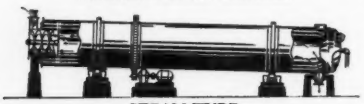
DRYERS, KILNS, COOLERS



DOUBLE-SHELL SEMI-DIRECT HEAT DRYERS



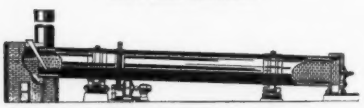
DOUBLE-SHELL INDIRECT-HEAT DRYERS



STEAM-TUBE INDIRECT-HEAT DRYERS

SINGLE-SHELL DIRECT-HEAT PARALLEL-FLOW DRYERS

SINGLE-SHELL DIRECT-HEAT HOT AIR DRYERS



ROTARY KILNS

ROTARY COOLERS

Ruggles-Coles Rotary Dryers, built by Hardinge, are available in the following styles:

CLASS XA
—Double shell, semi-direct heat. High efficiency. For materials that can be dried in direct contact with combustion gases and heated above 212°.

CLASS XB
—For materials that must be dried by indirect heat but can be heated above 212°. A double shell dryer with low dust loss.

CLASS XC
—Steam tube dryer for materials that must be dried by indirect heat and at low temperatures, such as chemicals, grains, food products.

CLASS XF
—For direct heat drying at temperatures above 212°. A single shell, counter-flow dryer that does not discharge the material through the furnace.

CLASS XH
—For direct heat drying at temperatures above 212°. A single shell, parallel flow dryer designed to handle sticky materials.

CLASS XW
—For material that can be dried by hot air at temperatures below 212°. Dries ammonium nitrate; potassium chloride, etc.

KILNS
—Rotary type for drying, calcining, roasting or oxidizing at temperatures above the range of ordinary dryers. Refractory lined.

COOLERS
—Air, water spray or submerged rotary type. Each designed for the efficient cooling of materials from kilns or roasters.

Write for Bulletin 16-D-52

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Fused-salt-bath electrolysis is a new one-step extraction process developed at the U. S. Bureau of Mines Laboratories, Reno, for separating tungsten from its impurities to produce commercial grade tungsten and molybdenum powders suitable for alloying. Bureau researchers successfully tested scheelite and obtained 98 percent molybdenum and better than 99 percent tungsten.

Scheelite concentrates mixed with alkali phosphates or borates are subjected to heating and low-voltage currents and make a cathodic deposit of molybdenum. Subsequently under increased voltage the tungsten is deposited from solution on a second cathode.

Principal advantages to the process are relative simplicity of plant, high current efficiency, reuse of electrolyte possible, and modest electrical requirements.

Recent acquisitions of Spokane National Mines include the Bannack and New Departure mines near Dillon, Mont. The company plans to operate a modernized 100 tpd cyanide mill at the Bannack gold property which has been virtually inactive since World War II. Other work under consideration calls for erection of a 150-ton flotation mill to treat silver ore from the New Departure.

About 100 claims have been located near Phillipsburg, Mont. by Bear Creek Mining Co. following investigation of copper mineralization on prospect dumps. The Kennecott Copper Corp. subsidiary has located the claims to give it breathing room in determining whether extensive exploration is warranted.

Exploratory work at American Smelting & Refining Company's Galena mine in the Coeur d'Alene district has resulted in discovery of a new vein which is reportedly similar to the original silver vein at that mine. It was intersected on the 3000-ft level by crosscut following diamond drilling that had revealed mineralization. The vein, narrower than the original, carries silver and copper values—although located in ground generally considered unfavorable. For the most part, silver production in the district currently comes from south of the Polaris fault—Galena's strike is on the north.

A contract to strip from 18,000,000 to 25,000,000 cu yd of over-

burden has been awarded to Maco Construction Co. of Rawlins, Wyo. Western Nuclear Corp. contracted this work in order to open a high grade uranium ore body in the Gas Hills area, Wyo. Stripping will be part of a five-phase program scheduled for completion in late 1961. Shallow ores encountered during stripping will be mined and stockpiled.

Renewed mining activity in southeastern Alaska is anticipated as a result of road construction that will eventually link Stewart, B. C., and nearby Hyder, Alaska, with the Alcan Highway. Canadian government agencies have allotted $12,000,000 to build a 24-ft road from Watson Lake, in the Yukon, to Stewart, B. C., a distance of about 300 miles, with completion slated for 1963.

Wah Chang Corp. has ordered a second electron-beam furnace for producing high purity columbium, tantalum, zirconium and hafnium at their Albany, Ore. facilities. The unit presently in use has been producing a total of about five tons per month of the above mentioned metals since installation last summer.

Strip mining will be used to work a gold-silver vein at Gold Crest Mining and Milling Company's operation in the Crested Butte area of Colorado. Gold Crest partially developed the property with expenditures of $150,000 over a two-month period before shutting down for winter. Plans call for erection of a 100-tpd flotation mill at the mine-site, where operations will be resumed in the spring.

Mineral Concentrates and Chemical Co. of Denver has begun production of beryllium oxide powder at its Loveland and Berthoud, Colo. plants. This is reported to be the nation's first commercial production of beryllium oxide from domestic ores, and the company is using a high-temperature chemical extraction process that upgrades hydroxide to the oxide. Mineral Concentrates and Chemical has contracted for all production from U. S. Beryllium Company's Boomer mine in Park County, Wyo. Previously, output from the Boomer had been placed in the government stockpile for lack of a commercial process to handle low grade beryl ores. Company plans call for ultimate production of 2000 lb per month, which will require a 40 man force at the two plants.

The tough ones come to Card

How HOMESTAKE solved two HAULAGE PROBLEMS

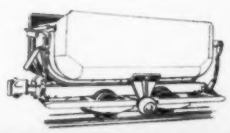
When Homestake Mining Company needed larger haulage capacity, Card engineers were called in. At Homestake, ore cars are automatically dumped while in motion, and haulage ways are limited in cross section. So, special Granby-type cars were chosen to replace the old gable-bottom cars.

Since 1939, 390 of these special Card cars have gone to Homestake on eight successive orders. Designed for maximum capacity, they have only a very minimum of side clearance. They are fabricated wholly of Cor-Ten plate and hold 60 cu. ft. Greatest design change over the years has been to a heavier liner plate to allow loading without the degree of ore fragmentation originally planned. Originally the cars were loaded through 14" grizzlies. Now they are loaded with the largest sizes that will clear the chutes.

Card has recently furnished 61 special Rocker Dump cars for development work at Homestake. These are well suited to handling waste and dumping in old stopes.

WHERE MINING CALLS

for efficient haulage, Card cars are the tested answer. Join Card's many customers. Their repeat orders are added proof of quality for you. Card engineers are at your service . . . no obligation.

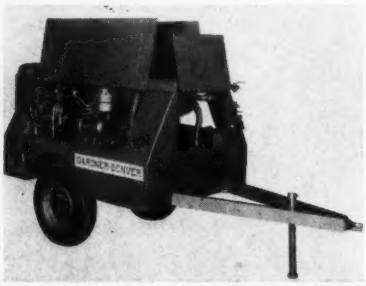


C.S. Card Iron Works Co.
2501 WEST 16th AVE.
DENVER, COLORADO

manufacturers forum

Rotary Portable Air Compressor

INCREASED HORSEPOWER and use of the Thriftmeter Control to regulate engine speed to meet air demand are reported features of the Gardner Denver 125 cfm compressor.



Model RP-125 also employs anti-blowback suction unloading valves and a larger toolbox which is both tamper-proof and weather-proof. An automatic water circulating system insures that the compressor and engine operate at a constant temperature despite temperature changes.

Smooth performance of the rotary delivers a steady supply of compressed air without pulsations and vibrations, and all rotary blades can be easily inspected by removing 12 cap screws.

Further details obtainable from Gardner-Denver Co., Quincy, Ill.

Electric Blasting Caps

IN MULTIPLE BLASTING, the Coal King delay electric blasting cap detonates complete rounds of permissible explosives without requiring the shotfirer to return to the face between blasts. This technique of rotational firing reportedly provides such greater safety advances as reduced exposure of the shotfirer to dust, fumes, and hazards of roof fall.

Productivity is said to be increased by decreasing the blasting time formerly required by single shots with instantaneous caps. Greater economy results from a claim of improved loadability over that previously obtainable in multiple blasting with instantaneous caps.

Manufactured with iron leg wires insulated with white plastic, this new cap is available in 15 different timing periods that range in 25-millisecond increments from 25 to 375 milliseconds.

More information is available from American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y.

Static Voltage Regulator

UNIQUE RATE FEEDBACK and industry proven zener diode sensing are used by the Sta-Vo-Trol voltage regulator, according to General Electric Company's Voltage Regulator Product Section, Pittsfield, Mass.

Static components eliminate tubes, brushes and other moving parts. Rated 1 kva, single phase, 0 to 8.5 amp, 120 volts, the regulator maintains a plus or minus 0.25 percent bandwidth accuracy for a constant power factor load.

Industrial Drawing-Computing Set

INCLUDING A RULER, T-SQUARE calibrated in inches and centimeters, French curve, a six-in. protractor, ten-in. 30°–60° triangle, 45°–90° triangle, Engineer's Scalemaster six-in. and Architect's Scalemaster six-in., and a six-in. slide rule, this set of professional drawing aids is now available on direct order from Edmund Scientific Co., Barrington, N. J. Stock No. 70,242.

Reversible Ratchet Bit Wrench

ABILITY TO CHANGE BITS on cutting equipment and continuous mining machines without removing the wrench for each stroke or for changing direction is claimed for the reversible ratchet bit wrench now available from North American Gear Co., 39 E. Campbell St., Blairsville, Pa. Designed for use on all machines using ¾-in. sq. head set screws, this wrench is said to assure firm, positive leverage in spaces where the clearance is too small for working with conventional tools. Wrench is 18⅝ in. long and requires less than ½-in. side clearance. It is precision ground and fit to assure dust-clear operation of the ratchet.

Resuscitator

CONTAINED IN A STURDY ALUMINUM CASE, the Back Pack resuscitator may be used in three ways: as a resuscitator, inhaling and exhaling for a victim until his breathing is restored; as an inhalator, continuously supplying oxygen; and as an aspirator, removing obstructions from the throat. Introduced by National Cylinder Gas Div., Chem-

etron Corp., Chicago, Ill., the unit also has dual outlets, permitting connection of a second resuscitator head and face mask so the bearer can also supply oxygen to himself when working in contaminated areas. Complete with its two oxygen cylinders the model weighs less than 30 lb.

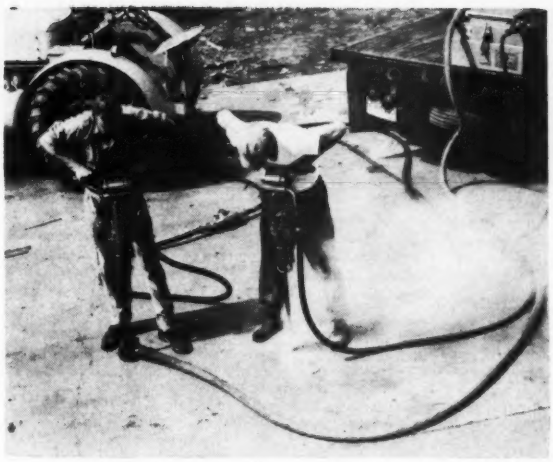
Picking Table

A SHORT STROKE HORIZONTAL Low Head picking table for hand removal of refuse from scalped run-of-mine coal has been announced by Allis-Chalmers Mfg. Co., Milwaukee 1, Wis. Equipped with a 1200-rpm motor, the table is available in 3, 4, 5 or 6-ft widths and in lengths up to 20 ft. Motion is imparted by a Low-Head mechanism. Requiring minimum head room, the table can be arranged for floor mounting on air or steel springs or can be suspended from an overhead structure. It is available with a portion of its carrying pan perforated to remove degradation or to make a separation.

Blending and Reclaiming Machine

A WHEEL AS HIGH AS A THREE-STORY BUILDING is said by Hewitt-Robins, Inc., Stamford, Conn., to be the key element in a blending and reclaiming machine recently designed and built to mix various grades of ore, cement, and other bulk materials to make them uniform and homogenous.

The rotating wheel, resembling a Ferris wheel, is fitted with two-ton capacity buckets which dig into stockpiled bulk materials and remove the pile at a rate of 300 to 500 tph. The wheel is mounted on a carriage which moves from side to side across the storage pile and also forward into the pile. As the buckets dig in, they remove a cross-section containing a portion of each of the various grades of material in the pile. This is accomplished because the pile has been systematically built up of alternate layers of material varying in richness, chemical analysis and size of particles. As the material is withdrawn from the pile, it is dumped into a large hopper which discharges to a conveyor system leading to another part of the plant.



A DRY, DUSTLESS DRILLING SYSTEM for use with hand held sinker drills and any brand of rock drills has been announced by Le Roi Div., Westinghouse Air Brake Co., Milwaukee 1 Wis. Dust and cuttings are "trapped" by a collar that fits around the drill steel and are "inhaled" through a connecting hose to a Le Roi DK280 dust collecting tank. This tank can be mounted on any compressor carrying truck or any portable compressor. The DK280 has a 23 in. wide, 16 in. long and 7 in. deep drawer that pulls out for disposal of dust and cuttings

ANNOUNCEMENTS

The recent acquisition of **Western Precipitation Corp.** of Los Angeles by **Joy Mfg. Co.,** Pittsburgh has resulted in some personnel changes. Western's former chairman, **Walter A. Schmidt** has become a Joy director, and **Alfred W. Knight,** former president of Western now becomes president of the new Western Precipitation division, as well as a vice president of Joy. Three former Western vice presidents **A. B. Reamer, N. M. McGrane,** and **R. F. Stewart** continue as vice presidents with the new division.

In a move to more effectively service the mining industry, **Wayne D. Gould** has been named to head the Mining Section of **The Dow Chemical Co.'s** Technical Service and Development Department. The section is responsible for laboratory and mill technical work on flotation and flocculating agents.

Ohio Brass Co. has announced promotion of **J. H. Sanford,** mining division manager since 1940, to manager, transportation department, succeeding **J. R. Palmer** who is retiring. Under Sanford the department will be known as the mining and transit department of which **M. F. Gowing** has been named assistant manager. Other company personnel changes include: **Robert A. LeFevre** from general advertising manager to manager of marketing services; **Joseph B. Polhemus, Jr.,** assistant advertising manager to general advertising manager; **D. E. Winters** from district manager, Chicago office to assistant general sales manager; and **A. W. Beatty** from sales engineer to district manager, Chicago office.

J. Sanford

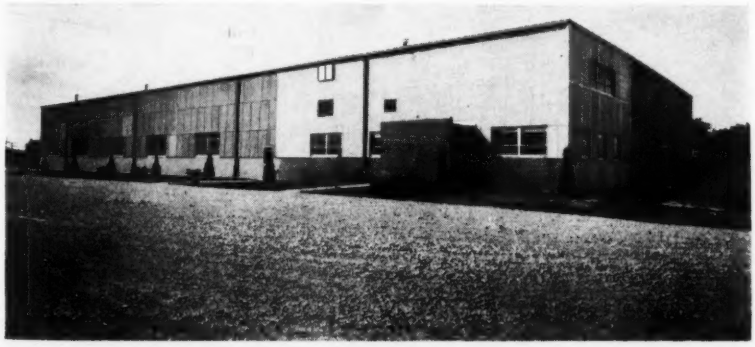
L. Richard Malley has been appointed advertising manager of **Climax Molybdenum Co.**

Heyl and Patterson, Inc., has announced the retirement of **Thomas F. Baker,** sales-service manager,

T. Baker

W. Hoffee

and a 60 year veteran of the company. He was honored at the company's annual Quarter Century Club banquet. He will be succeeded by **W. L. Hoffee,** formerly assistant manager of sales and service.



A NEW PLANT was recently opened at Belleville, Ill., by J.M.J. Industries, Inc., and its T. J. Gundlach Machine Co. Division. The need for increased production and future expansion played an important role in final plant design and layout. For almost a decade T. J. Gundlach Machine Co., said to be the originator of "two stage" crushing in one operation, has been manufacturing and supplying crushing equipment for use primarily in the coal, coke, salt and glass industries

CATALOGS & BULLETINS

TRACTORS. *Caterpillar Tractor Co., Peoria, Ill.* Production and mechanical advantages of the D9 series E tractor and of the power shift transmission are given in Brochure 33544. Reported improvements to this vehicle include a new transmission, an increase to 335 flywheel hp, an equalizer bar said to give greater stability, hydraulically controlled bulldozer, a new hydraulic control and an improved undercarriage.

MECHANICAL CONVEYOR SCREENS. *Syntron Co., 703 Lexington Ave., Homer City, Pa.* The mechanical conveyor screens described in this catalog are designed for the scalping and coarse and medium sizing of a wide range of bulk materials. The illustrated section contains complete descriptions, specifications, and data for three standard mechanical conveyor screen models.

MECHANIZED SUPPORT SYSTEM. *Dowty Mining Equipment Ltd., 25 Beaver St., New York 4 N. Y.* Explanation of the construction, engineering and application of the Roofmaster, a fully mechanized support system for longwall coal mining, is contained in this publication.

CRUSHER. *Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.* Bulletin 17B9296 describes mechanical features of the 36-in. Hydrocone crusher and carries a table of approximate capacities. The crusher is 4 ft 10 in. high, but is said to afford big machine advantages. The crusher can be had with fine, intermediate, or coarse crushing chambers.

JEFFREY LITERATURE. *Jeffrey Mfg. Co., Columbus 16, Ohio.* Three new catalogs are now available. They are 951 which covers the Jeffrey Spiral Conveyor and is amply illustrated and charted in support of textual material; 941 describing the Jeffrey Waytrol line of weighing, batching, and proportioning equipment; 978 presenting a quick panoramic view of Jeffrey equipment line for the processing industries including such mechanisms as feeders, conveyors, cooler and dryers.

VALVES. *Ohio Brass Co., Mansfield, Ohio.* Folder 1443-V shows the company's globe, angle, check and gate valves for industrial use and includes charts listing valves by figure numbers, sizes, types of discs, types of pipe ends and pressure ratings.

REVOLUTION ON WHEELS. *LeTourneau-Westinghouse Co., 2301 N.E. Adams St., Peoria, Ill.* The full-color, 16-mm movie about the Haulpak off-highway truck, which is the name of L-W's line of 27, 32 and 80-ton off-highway haulers, shows units working on job locations around the country and attempts to portray the varying working conditions and climates under which this vehicle is capable of operating.

PENDENT SWITCH. *Electrical Products Div., Joy Mfg. Co., 1201 Macklind Ave., St. Louis 10, Mo.* Recently released illustrated literature indicates that the Joy Pendent "Safe" Switch is now available in a 6-station as well as a 4-station model. The bulletin is designed to let the reader visualize for himself the construction of the new model and its components. The unit, which is enclosed in HyCar, a synthetic rubber compound, is said to be completely watertight and corrosion-proof.

DRILLING TOOLS. *Brunner & Lay, Inc., 9300 W. King St., Franklin Park, Ill.* Catalog No. 759, revised, contains illustrations and specifications of every tool in line, including carbide Rok-Bits, drill rods, striking bars, extension steel as well as a variety of demolition tools. Includes details on new line of rope thread blast hole drilling tools.

ATTACHABLE CABLE COUPLERS. *Brad Harrison Co., 4222 Warren Ave., Hillside, Ill.* Amply illustrated and containing a number of explanatory charts, the bulletin covers permissible and fresh air couplers and auxiliary parts.

CRAWLER PARTS. *Taylor-Wharton Co., High Bridge, N. J.* Brochure illustrates the Tisco line of bulldozer sprocket rims, tractor pads, end bits, and blades. It describes procedures for rapid installation of the sprocket rims, outlines advantages of the parts described, and tabulates stock part specifications for all first-line crawlers.

ANNUNCIATOR SYSTEMS. *Panalarm Div., Panellit, Inc., Skokie, Ill.* Complete with equipment photographs, charts, and diagrams, the 52-page catalog 100C is claimed to be the most comprehensive single source of information on annunciator systems ever published.

ENGINES. *International Harvester Co., 180 N. Mich. Ave., Chicago 1, Ill.* Catalog CR-608-I describes a line of six-cylinder interchangeable diesel and carbureted engines. Included are the UC-221 carbureted and UD-236 diesel engines rated at 75 maximum hp, and the UC-263 carbureted and UD-282 diesel units rated at 95 maximum hp.

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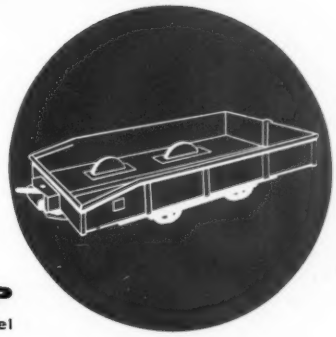
DROP BOTTOM
4 wheel or 8 wheel



END DUMP
4 wheel

ROTARY DUMP
4 wheel or 8 wheel

acf MAKES ALL THREE

No matter what type of car your mining operations call for acf has a car to fit your needs. acf mine cars are built in all types and sizes from 2 to 30 tons, or more.

For safety, low maintenance and high speed constant haulage all acf mine cars have special features developed through many years of experience in design and manufacture.

Anti-friction bearings in the load-support wheels permit safe high speed from loading point to unloading point and back again for more. Automatic couplers make car handling safer and faster. acf double-action spring bumpers lower maintenance on everything from trackage to locomotive...provide smoother, safer hauling.

For complete information about the full line of acf Constant Haulage Mine Cars in all sizes and types contact the nearest acf sales office or discuss your haulage problems with one of our sales representatives.

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Division of acf Industries, Inc.
750 Third Avenue, N.Y. 17, N.Y.

SALES OFFICES:
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PHILADELPHIA
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HUNTINGTON, WEST VA.
CHICAGO
ST. LOUIS
SAN FRANCISCO

Now—more light, less weight, longer life with

NEW EDISON MODEL S ELECTRIC CAP LAMP

MSA announces another new *high* in lighting efficiency in the world's most popular cap lamp. Increased light output of the new Edison Model S Lamp assures greater safety for the miner, more tons per shift for the operator. Let's face a fact: Dimness costs money. *Fair* lighting does only a *fair* job. Maximum lighting—the brilliant, unfailing Edison Model S kind—helps get jobs done with top speed and safety. And the simplified method of charging new Model S Batteries—with the AUTOMATIC LOW-VOLTAGE SYSTEM—is convenient, thrifty and highly efficient. Lets miners take their lamps and rack them—quickly—without loss of time or waste motion. When planning a new lamphouse installation or modernizing your present one, call in the MSA Representative. MSA can help you solve your lighting problems.

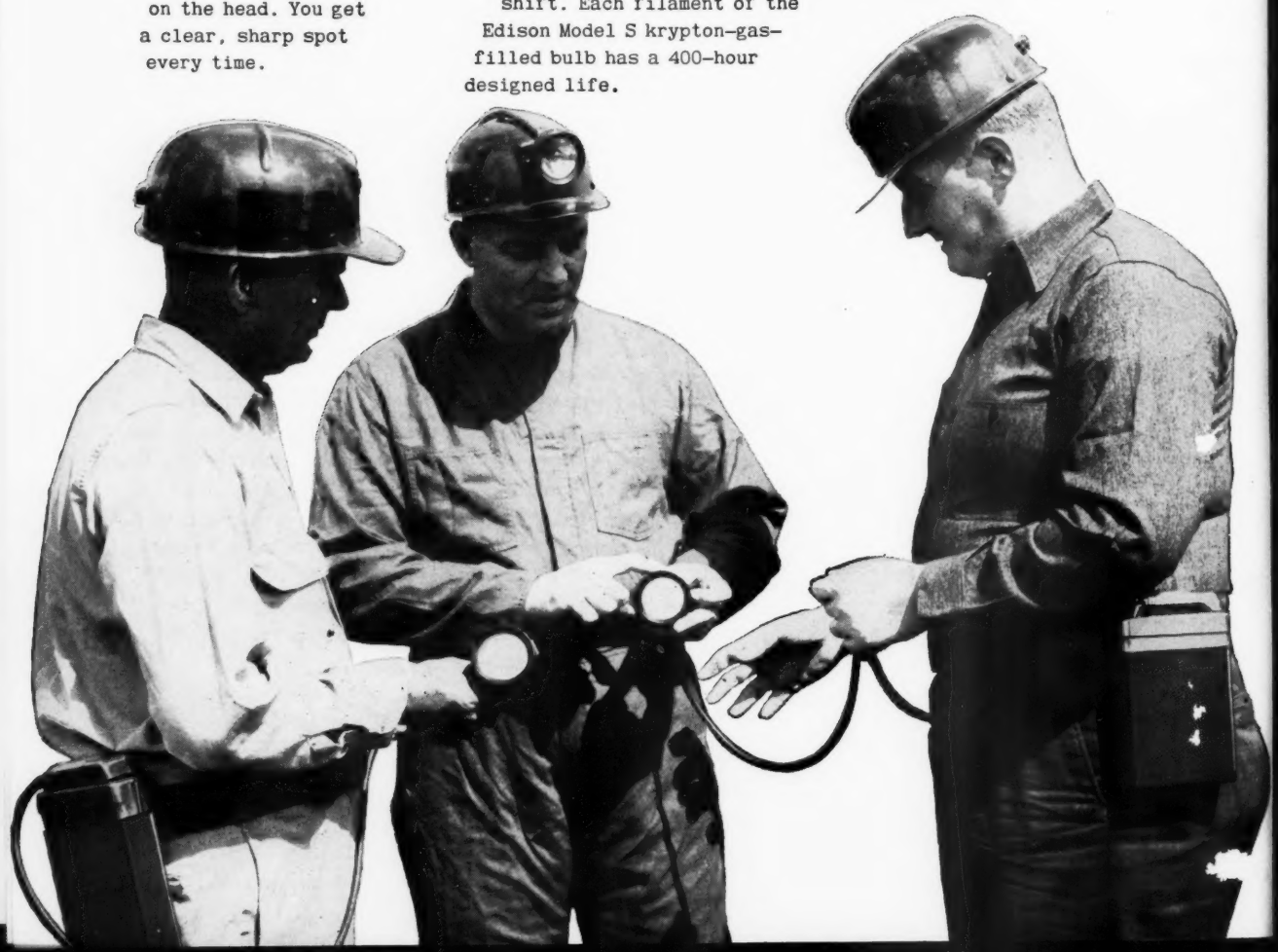
Newly issued U.S. Bureau of Mines Approval 6D-31, April 16, 1959.

MSA SAFETY EQUIPMENT HEADQUARTERS

MINE SAFETY APPLIANCES COMPANY • 201 North Braddock Avenue, Pittsburgh 8, Pennsylvania

MINE SAFETY APPLIANCES CO. OF CANADA, LIMITED • Toronto, Calgary, Edmonton, Montreal, Sydney, Vancouver, Winnipeg

Look how small the headpiece is. Weighs only a few ounces. Feels even lighter on the head. You get a clear, sharp spot every time.

Increase in working light appeals to me. This new Edison Model S gives 15% more than we ever had before. And they didn't cut their bulb service life rating to do it. The double filament bulb means we'll always have working light to finish the shift. Each filament of the Edison Model S krypton-gas-filled bulb has a 400-hour designed life.

Just watch the improvement in our safety and tonnage reports. More light. Less weight. Longer life. Even the battery's better. It has a new active material that boosts service life. They went all-out to meet the miner's needs with this one.